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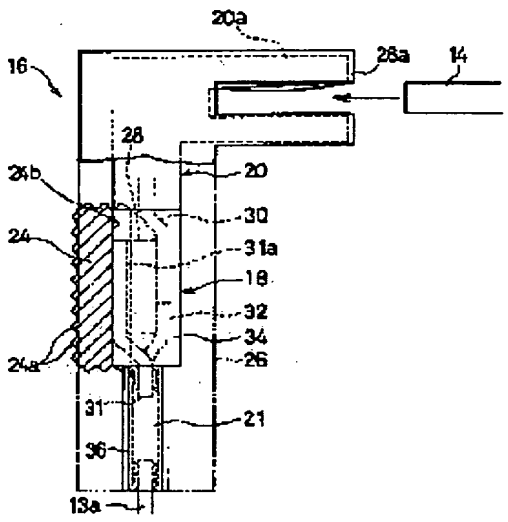
(54) CONNECTOR AND ELECTRICAL CONNECTION BOX

(57)Abstract:

PROBLEM TO BE SOLVED: To efficiently protect another electronic device from heat radiation of a control device by connecting the control device to an electric current circuit through a first connecting member and connecting the control device to a control circuit througha second connecting member.

SOLUTION: An electric field effect transistor(FET) 18 and a heat radiating plate 24 are integrally connected to each other in a state where a heat radiating part 31a of the FET 18 and the heat radiating plate 24 make contact with each other. As an electric current which is the same as an electric current flowing in a bus bar circuit flows in the FET 18, heat radiation takes place in the FET 18. As the FET 18 is



arranged at a position between a bus bar substrate 13 and an electronic circuit substrate 14 in a state of being separated from both of the substrates 13, 14 in an electrical connection box and the heat radiating plate 24 making contact with a heat radiating part 31a of the FET 18 is in a state of being exposed outside of a connector housing 26, heat radiating work of this FET 18 is high, and it is possible to prevent its radiated heat from badly influencing upon each of electronic devices on the electronic circuit substrate 14.

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The connector characterized by incorporating at one the 1st connection member for connecting the control device and this control device for controlling the current which flows a current circuit in the above-mentioned current circuit, and the 2nd connection member for connecting the above-mentioned control device to the control circuit which controls actuation of this device in connector housing.
[Claim 2] The connector characterized by having formed the radiator in the above-mentioned control device, and exposing this radiator to the exterior of the above-mentioned connector housing in a connector according to claim 1.
[Claim 3] The connector characterized by having formed the radiator in the above-mentioned control device, and having connected with the radiator concerned the radiator material which has bigger surface area than this radiator in the connector according to claim 1, and exposing this radiator material to the exterior of the above-mentioned connector housing.
[Claim 4] The connector characterized by making the cooling component which cools the above-mentioned radiator in a connector according to claim 3 by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator between the radiator of the above-mentioned control device, and the above-mentioned radiator material intervene.
[Claim 5] The connector characterized by including in one the connection member for cooling which connects the above-mentioned cooling component to the above-mentioned connector housing in the control circuit of the 2nd circuit board of the above in a connector according to claim 4.
[Claim 6] The connector characterized by the connection member of the above 1st and the 2nd connection member having turned to the opposite direction mutually in a connector according to claim 1 to 5.
[Claim 7] The connector characterized by making the separator which consists of an insulating material among two or more 1st connection members intervene in a connector according to claim 6.
[Claim 8] The electric junction box characterized by arranging the above-mentioned control device in the location between the 1st circuit board of the above, and the 2nd circuit board while having the 1st circuit board in which the current circuit was included, a control device for controlling the current which flows the above-mentioned current circuit, and the 2nd circuit board in which the control circuit which controls actuation of this control device was included.
[Claim 9] an electric junction box according to claim 8 -- setting -- the 1st circuit board of the above, and the 2nd circuit board -- abbreviation, while making it estrange mutually and arranging in the parallel condition The control device with which the control terminal connected with two or more energization terminals connected to the current circuit of the 1st circuit board of the above in the control circuit of the 2nd circuit board of the above projects in the opposite direction mutually The electric junction box with which the above-mentioned energization terminal is characterized by arranging among both substrates in the condition that the above-mentioned control terminal turns to the circuit board side of the above 2nd toward the circuit board side of the above 1st.
[Claim 10] The electric junction box characterized by connecting radiator material with larger surface area than this radiator with the radiator of the above-mentioned control device in an electric junction box according to claim 8 or 9.
[Claim 11] The electric junction box characterized by connecting the common radiator material prolonged in the radiator of these control devices at the 2nd circuit board of the above, and abbreviation parallel in an electric junction box according to claim 10 while installing two or more control devices between the 1st circuit board of the above, and

the 2nd circuit board.
[Claim 12] The electric junction box characterized by making the cooling component which cools a radiator in an electric junction box according to claim 10 or 11 by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator between the radiator of the above-mentioned control device, and the above-mentioned radiator material intervene.
[Claim 13] The electric junction box characterized by including the cooling control section which controls actuation of the above-mentioned cooling component based on the temperature detected by this temperature detection means in the 2nd circuit board of the above while having a temperature detection means to detect the temperature of the above-mentioned control device, or the temperature corresponding to this, in the electric junction box according to claim 12.
[Claim 14] The 1st circuit board in which the current circuit was included, and the connector according to claim 1 to 7 into which the control device for controlling the current which flows the above-mentioned current circuit was built, The electric junction box characterized by having had the 2nd circuit board in which the control circuit which controls actuation of the above-mentioned control device was included, having connected the above-mentioned current circuit to the 1st connection member of the above-mentioned connector, and connecting the above-mentioned control circuit to the 2nd connection member of the above-mentioned connector.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the connector and electric junction box which are used for the wire harness for automobiles etc.
[0002]
[Description of the Prior Art] An example of the circuitry in the conventional electric junction box is shown in drawing 17 . In drawing, the bus bar substrate (the 1st circuit board) 90 and the electronic-circuitry substrate (the 2nd circuit board) 92 are arranged on abbreviation parallel, and the connector 94 is interposed between both the substrates 90 and 92 comrades.
[0003] A power circuit etc. is connected to the bus bar circuit (current circuit) included in the bus bar substrate 90 through the electric wire of figure abbreviation etc., and a comparatively big current is passed by this bus bar circuit in it. On the electronic-circuitry substrate 92, FET (field-effect transistor)96, the gate signal input circuit which inputs a gate signal (control signal) into the gate terminal of this FET96 are carried. And the energization terminal (a source terminal and drain terminal) of the above FET 96 is connected to the above-mentioned bus bar circuit through the flow section in the above-mentioned connector 94, and the current which flows the above-mentioned bus bar circuit is controlled by the gate signal inputted into this FET96.
[0004] Thus, although a current equivalent to the current which flows a bus bar circuit is passed between the source drains of the above FET 96, this current is remarkably large compared with the current which flows the control circuit of the electronic-circuitry substrate 92, and, therefore, the calorific value of FET96 becomes very large compared with the electron device mounted on the same electronic-circuitry substrate 92. Then, while carrying out exposing some energization terminals on the front face of FET96 etc. that this FET96 should be cooled effectively and forming a radiator conventionally, means like the illustration to this radiator to connect the heat sink 98 of a large area comparatively are taken.
[0005]
[Problem(s) to be Solved by the Invention] With the above-mentioned configuration, since FET96 is directly mounted on the circuit board 92, propagation and a possibility of doing a bad influence at actuation of these devices are in other electron devices with which the heat released out of FET96 was mounted on the same electronic-circuitry substrate 92.
[0006] This invention aims at offering the connector and electric junction box which can protect other electron devices from heat dissipation of control devices including FET effectively in view of such a situation.
[0007]
[Means for Solving the Problem] As above-mentioned The means for solving a technical problem, this invention incorporates at one the 1st connection member for connecting the control device and this control device for controlling the current which flows a current circuit in the above-mentioned current circuit, and the 2nd connection member for connecting the above-mentioned control device to the control circuit which controls actuation of this device in connector housing.
[0008] According to this connector, while connecting that control device to a current circuit through the 1st connection member, the current of a current circuit is controllable by this control device, controlling actuation of a control device by this control circuit by connecting the above-mentioned control device to a control circuit through the 2nd connection member. In this condition, since it is in the location where the above-mentioned control device separated from the

above-mentioned control circuit, it prevents telling the heat released out of the control device directly to other electron devices on the above-mentioned control board etc. unlike the structure of mounting the above-mentioned control device on a control board like before.

[0009] In this connector, if a radiator is formed in the above-mentioned control device and this radiator is exposed to the exterior of the above-mentioned connector housing, heat can be more efficiently radiated in the heat with which a control device emits a control device compared with structure conventionally which is mounted on a control board, and that fault temperature up can be prevented.

[0010] Moreover, if the radiator material which has bigger surface area than the radiator of the above-mentioned control device is connected with the radiator concerned and this radiator material is exposed to the exterior of the above-mentioned connector housing, the heat dissipation operation from this control device will be raised further.

[0011] Although the above-mentioned radiator material may be directly contacted to the radiator of the above-mentioned control device, if the cooling component which cools a radiator by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator among these is made to intervene, the heat dissipation from a radiator can be promoted further.

[0012] Furthermore, when the connection member for cooling which connects the above-mentioned cooling component to the control circuit of the 2nd circuit board of the above is included in one and the cooling component and the control circuit were connected to the above-mentioned connector housing through this connection member for cooling, it was also able to be said that actuation of a cooling component was controlled using this control circuit.

[0013] As for the connection member of the above 1st, and the 2nd connection member, it is desirable that these have turned to the opposite direction mutually. Thereby, the activity which connects a control device to the both sides of a current circuit and a control circuit becomes easy, and wiring structure also becomes easy.

[0014] It can avoid more certainly that energization terminals short-circuit by making the separator which consists of an insulating material intervene among the above-mentioned energization terminals in that case.

[0015] Moreover, this invention is the electric junction box which arranged the above-mentioned control device in the location between the 1st circuit board of the above, and the 2nd circuit board while being equipped with the 1st circuit board in which the current circuit was included, the control device for controlling the current which flows the above-mentioned current circuit, and the 2nd circuit board in which the control circuit which controls actuation of this control device was included.

[0016] In this configuration, since the semiconductor device is arranged among both substrates, compared with structure, it is easy to radiate heat from a semiconductor device conventionally by which this semiconductor device is mounted on the 2nd circuit board, and that fault temperature up is avoided. Moreover, telling the heat released out of this semiconductor device directly to the electron device of the 2nd circuit board etc. can also be prevented. And since the semiconductor device is originally arranged among both the substrates that are carrying out mutual alienation, it does not need to enlarge the whole electric junction box, and connection between a semiconductor device and both substrates is also easy for it.

[0017] especially -- the 1st circuit board of the above, and the 2nd circuit board -- abbreviation -- as the above-mentioned semiconductor device, when making it estrange mutually and arranging in the parallel condition If that to which the control terminal connected with two or more energization terminals connected to the current circuit of the 1st circuit board of the above in the control circuit of the 2nd circuit board of the above projects in the opposite direction mutually is used Connection with the circuit included in each terminal and each substrate of this semiconductor device can be simply performed by arranging a semiconductor device among both substrates, where it turned that energization terminal to the circuit board side of the above 1st and the above-mentioned control terminal is turned to the circuit board side of the above 2nd.

[0018] Moreover, if radiator material with larger surface area than this radiator is connected with the radiator of the above-mentioned semiconductor device, the heat dissipation operation from this semiconductor device will be raised further.

[0019] Although neither the configuration of this radiator material nor especially arrangement is asked, while installing two or more semiconductor devices between the 1st circuit board of the above, and the 2nd circuit board If the common radiator material prolonged in the 2nd circuit board of the above and abbreviation parallel is connected with the radiator of these semiconductor devices, using effectively the space inserted into both substrates, the radiator material of a large area can be introduced without making the whole electric junction box enlarge, and the part heat dissipation operation

can be promoted further. Moreover, since heat dissipation of two or more semiconductor devices by common radiator material can be promoted, components mark are also reduced compared with the case where radiator material is allotted for every semiconductor device. Furthermore, since the above-mentioned radiator material will be in a wrap condition from one side about the 2nd circuit board of the above, it also becomes possible to make this radiator material serve a double purpose as shielding material of the 2nd circuit board.

[0020] Although the above-mentioned radiator material may be directly contacted to the radiator of the above-mentioned semiconductor device, if the cooling component which cools a radiator by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator among these is made to intervene, the heat dissipation from a radiator can be promoted further.

[0021] Although un-arranging [that dew condensation occurs on the front face of this semiconductor device] may arise here when cooling of a semiconductor device is unnecessary (at for example, the time of un-operating), it carries out that a cooling component operates etc. and a semiconductor device is supercooled Like a Peltier device, by the supply current from the outside etc., when the above-mentioned cooling component is a component in which actuation control is possible, while it is equipped with a temperature detection means to detect the temperature of the above-mentioned semiconductor device, or the temperature corresponding to this By including the cooling control section which controls actuation of the above-mentioned cooling component based on the temperature detected by this temperature detection means in the 2nd circuit board of the above, proper temperature control corresponding to the actual condition can be performed.

[0022] Although you may make it arrange the above-mentioned semiconductor device among both substrates independently, said each connector is used, i.e., the assembly operation of the whole electric junction box becomes easy by connecting the above-mentioned current circuit to the 1st connection member of this connector, and connecting the above-mentioned control circuit to the 2nd connection member of the above-mentioned connector.

[0023]

[Embodiment of the Invention] The gestalt of operation of the 1st of this invention is explained based on drawing 1 - drawing 7 .

[0024] The electric junction box 10 shown in drawing 1 is equipped with the lower case 11 and the upper case 12. Engagement section 11b is formed in side-attachment-wall 11a of a lower case 11, engagement section 12b is formed in side-attachment-wall 12a of an upper case 12, and both the cases 11 and the connection condition of 12 comrades are held by engagement of both engagement section 11b and 12b.

[0025] The bus bar substrate 13 is arranged on the above-mentioned lower case 11. Much tab 13a has started from this bus bar substrate 13 to the upper part. A power circuit etc. is connected to the bus bar circuit (current circuit) included in this bus bar substrate 13 through the electric wire of figure abbreviation etc., and a comparatively big current is passed by this bus bar circuit in it.

[0026] Rather than the above-mentioned bus bar substrate 13, two or more stanchion 11c which projects up further is set up by the periphery section of a lower case 11, and the electronic-circuitry substrate 14 is supported by such stanchion 11c. namely, this electronic-circuitry substrate 14 -- the above-mentioned bus bar substrate 13 and abbreviation -- it is in an parallel condition and is supported by the location estranged from this bus bar substrate to the upper part. Many electron devices 15 are mounted in this electronic-circuitry substrate 14, and the control circuit which inputs a gate signal into below-mentioned FET18 with these electron devices 15 is constituted.

[0027] And the connector 16 as shown in drawing 2 - drawing 6 is interposed between this electronic-circuitry substrate 14 and the above-mentioned bus bar substrate 13. This connector 16 is equipped with the above FET 18 and the gate splicing fitting (2nd connection member) 20 which are a control device, the drain splicing fitting (1st connection member) 21, the source splicing fitting (2nd connection member) 22, and a heat sink 24, and these whole is included in the connector housing 26 made of resin by one with mold shaping.

[0028] The connector housing 26 is prolonged in the periphery section of the electronic-circuitry substrate 14, and parallel, and the upper limit section is crooked in the electronic-circuitry substrate 14 side. a part for and this flection -- the two forks in which the side to the plug of the periphery section of the above-mentioned electronic-circuitry substrate 14 is possible -- clip section 26a of a ** is formed.

[0029] The semiconductor chip 28 which is an FET body, a gate terminal (control terminal) 30, the drain terminal (energization terminal) 31, and the source terminal (energization terminal) 32 are covered with the housing 34 made of resin, and FET18 can be manufactured with mold shaping etc., as shown in drawing 7 (a) - (c).

[0030] The above-mentioned gate terminal 30 and the source terminal 32 are joined by the side face (drawing 7 (b) right lateral) of the same side in the above-mentioned semiconductor chip 28, and the above-mentioned drain terminal 31 is connected to the side face of this and the opposite side. The part joined by the above-mentioned side face in this drain terminal 31 is set to radiator 31a which has an area equivalent to the side face concerned, and this radiator 31a has exposed it to the side face of the above-mentioned housing 34.
[0031] Furthermore, as a description of this FET18, among the three above-mentioned terminals 30-32, only the gate terminal 30 was prolonged in the upper part from the above-mentioned semiconductor chip 28, and it has projected from the top face of housing 34 to the upper part, and the remaining drain terminal 31 and the remaining source terminal 32 were caudad prolonged in abbreviation parallel in the condition of having ranked with right and left mutually, and are caudad projected from the inferior surface of tongue of housing 34 in it, respectively.
[0032] The gate splicing fitting 20 is arranged on the upper part of a connector 16, and the lower limit of this gate splicing fitting 20 is connected with the gate terminal of the above FET 18. the upper part of this gate splicing fitting 22 -- the side -- being crooked -- a part for that point -- clip section 26a of the above-mentioned connector housing 26 -- the same -- the two forks (namely, the side to a plug is possible for the electronic-circuitry substrate 14) which can pinch the periphery section of the above-mentioned electronic-circuitry substrate 14 from the upper and lower sides -- clip section 20a of a ** is formed. and the conductor which constitutes the control circuit of this electronic-circuitry substrate 14 after this clip 20a has pinched the periphery section of the electronic-circuitry substrate 14 -- partial 14a contacts the above-mentioned clip section 20a, and the above-mentioned control circuit is electrically connected to the gate terminal 30 of FET18 through the gate splicing fitting 20.
[0033] The drain splicing fitting 21 and the source splicing fitting 22 are making mutually the same configuration and the configuration which is specifically prolonged up and down and has the engagement section of a female mold to the vertical both ends, the lower limit section of the drain terminal 31 of the above FET 18 is inserted in the upper limit section of the drain splicing fitting 21, and the lower limit section of the source terminal 32 is inserted in the upper limit section of the source terminal 22.
[0034] The separator 36 which consists of an insulator intervenes between both the splicing fitting 21 and 22 comrades. The whole is unified by mold shaping and, as for these splicing fitting 21 and 22 and a separator 36, the insulation of both the splicing fitting 21 and 22 comrades is secured by mediation of this separator 36. And these tab 13a is connected to the above-mentioned drain terminal 31 and the source terminal 32 according to an individual through each splicing fitting 21 and 22 by inserting suitable tab 13a in the above-mentioned bus bar substrate 13 in the lower limit section of both the splicing fitting 21 and 22 from a lower part. That is, FET18 is incorporated all over a bus bar circuit.

[0035] A heat sink 24 is fabricated with the ingredient excellent in conductivity, such as aluminum, and has the configuration prolonged at a horizontal to the dimension of the connector housing 26 and an abbreviation EQC. And after the front face of this heat sink 24 has been exposed to the lateral surface (the side face of the electronic-circuitry substrate 14 and the opposite side; drawing 2 right lateral) of the connector housing 26, this heat sink 24 is also included in the connector housing 26. Protruding line 24a of a large number prolonged horizontally is formed in the front face of this heat sink 24, and, thereby, the heat sinking plane product of a heat sink 24 is increased.
[0036] Crevice 24b is formed in the medial surface of this heat sink 24, and by inserting in this crevice 24b one flank (flank of the side which radiator 31of drain terminal 31a a has specifically exposed) of the housing 34 of FET18, after radiator 31a of FET18 and a heat sink 24 have contacted, these FET18 and a heat sink 24 are combined with one.
[0037] Next, an operation of this electric junction box 10 is explained.
[0038] There are some bus bar circuits which were included in the bus bar substrate 13 and into which a comparatively big current is inputted through the electric wire of figure abbreviation etc. The middle, the comparatively big current passed in this circuit flows in order of source terminal 32 -> semiconductor chip 28 -> drain terminal 31 -> drain splicing fitting 21 -> tab 13a of tab 13a-> source splicing fitting 22 ->FET18 shown in drawing 2 - drawing 6 , and is outputted from a bus bar circuit. On the other hand, a gate signal is inputted into the gate terminal 30 of the above FET 18 through the gate splicing fitting 20 from the control circuit included in the electronic-circuitry substrate 14, and the amount of energization between the source-drains in the above FET 18 is controlled by this gate signal.
[0039] Thus, since a current equivalent to the current which flows a bus bar circuit flows to FET18, generation of heat takes place to FET18. Since FET18 was conventionally mounted on the electronic-circuitry substrate 14 with other electron devices here, Although sufficient heat dissipation operation had a possibility that the heat which is hard to be

obtained and this FET18 emits might get across to other electron devices, and might have a bad influence also on the engine performance of these electron devices even if it connected the heat sink etc. with this FET18 With the electric junction box 10 shown in drawing 1 - drawing 7 , after FET18 has separated from the both sides of the bus bar substrate 13 and the electronic-circuitry substrate 14, it is allotted to the location between both the substrates 13 and 14 comrades. Since the heat sink 24 in contact with radiator 31a of FET18 is in the condition of having exposed to the way outside the connector housing 26, a heat dissipation operation of this FET18 is high, and it can prevent that released heat having a bad influence on each electron device on the electronic-circuitry substrate 14. And since both the substrates 13 and 14 are arranged in the condition of having estranged mutually from the first, although FET18 is arranged among these, it is not necessary to enlarge especially the electric junction box 10.

[0040] The gestalt of the 2nd operation is shown in drawing 8 . Although the heat sink 24 which turned radiator 31a of FET18 to the lateral surface of a connector 16, and was connected with this radiator 31a is exposed to the above-mentioned lateral surface with the gestalt of said 1st operation, with the gestalt of this 2nd operation, the above-mentioned radiator 31a was turned to the medial surface of a connector 16, and the heat sink 24 connected with this heat sink 31a is turned to the above-mentioned medial surface.

[0041] Thus, what is necessary is to have not asked concrete arrangement of the radiator material of heat sink 24 grade, but just to fully have exposed it from the connector housing 26 in this invention.

[0042] The gestalt of the 3rd operation is shown in drawing 9 . Here, the both ends of the electronic-circuitry substrate 14 are connected with the bus bar substrate 13 through the connector 16. That is, two connectors 16 are arranged in the condition of carrying out phase opposite, between the electronic-circuitry substrate 14 and the bus bar substrate 13. And radiator 31a of FET18 included in each connector 16 is directly exposed to the field (medial surface) which counters mutually in each connector 16, and the single heat sink 38 is connected with it at these radiator 31a. namely, this heat sink 38 -- between the bus bar substrate 13 and the electronic-circuitry substrates 14 -- these and abbreviation -- it is allotted in the parallel condition and intervenes among radiator 31a of both the connectors 16. moreover -- the inferior surface of tongue of this heat sink 38 -- many -- fin of several sheets 38a is formed and, thereby, the increment in a heat sinking plane product is achieved.

[0043] According to such a configuration, in addition to the effectiveness acquired with the gestalt of said the 1st and 2nd operation, the following effectiveness can be acquired.

[0044] ** The heat sink 38 of a large area can be arranged by using effectively the space inserted into the bus bar substrate 13 and the electronic-circuitry substrate 14, without enlarging the electric junction box 10 whole. Therefore, though it is compact structure, the outstanding heat dissipation operation can be acquired.

[0045] ** By the common heat sink 38, the heat dissipation from FET18 in two or more connectors 16 can be promoted, and components mark can be reduced.

[0046] ** By the metal heat sink 38, since the inferior surface of tongue of the electronic-circuitry substrate 14 can be mostly covered over the whole region, this heat sink 38 can be made to serve a double purpose as shielding material, and, thereby, can protect the electronic-circuitry substrate 14 from an electromagnetic wave effectively. Furthermore, a shielding effect will become thoroughgoing, if a metal plate is arranged also on said upper case 12 and the electronic-circuitry substrate 14 is covered with a metal plate also from the upper part.

[0047] Next, the gestalt of the 4th operation is explained based on drawing 10 - drawing 12 .

[0048] With the gestalt of this operation, Peltier device (cooling component) 40 is interposed between radiator 31a of FET18, and a heat sink 24 in the connector 16 shown with the gestalt of said 1st operation. This Peltier device 40 is equipped with the terminal of a pair, and in connection with a current being passed among these terminals, it is a degree corresponding to the magnitude of this current, and it is constituted so that heat transfer may be made to start in the direction which goes to a heat sink 24 from above-mentioned radiator 31a compulsorily.

[0049] On the other hand, the temperature sensor (temperature detection means) 42 as shown in drawing 12 is built into said FET18. This temperature sensor 42 consists of a thermocouple etc., and it is constituted so that the electrical signal equivalent to the exoergic temperature of FET18 may be outputted.

[0050] As shown in drawing 11 , the splicing fitting 50A and 50B for cooling (connection member for cooling) and the splicing fitting 52 for detection (connection member for detection) of a pair of a configuration (namely, configuration which has the clip section whose electronic-circuitry substrate 14 is pinched) equivalent to this gate splicing fitting 20 are built into the upper part of a connector 16 in the condition of standing in a line at a level with said gate splicing fitting 20. Each terminal of said Peltier device 40 is connected to each splicing fitting 50A and 50B for cooling through

wiring in a connector of figure abbreviation, and the output terminal of the above-mentioned temperature sensor 42 is connected to the splicing fitting 52 for detection. And the above-mentioned gate terminal 30, the both-ends child of Peltier device 40, and the output terminal of a temperature sensor 42 are connected concurrently to the control circuit included in this electronic-circuitry substrate 14 by inserting the periphery section proper place of the electronic-circuitry substrate 14 in the clip section of each above-mentioned splicing fitting 20, 50A, 50B, and 52 at coincidence.
[0051] The control circuit included in the above-mentioned electronic-circuitry substrate 14 is equipped with the temperature data analysis section 44 and the current controller 46 as shown in drawing 12 besides the above-mentioned gate signal generating section, and the warning command section 48.
[0052] The temperature data analysis section 44 is constituted so that the temperature data inputted from a temperature sensor 42 are analyzed, the control signal corresponding to the temperature may be outputted to the current controller 46 when detection temperature is beyond the 1st decision value, and a warning control signal may be outputted at the warning command section 48 in beyond the 2nd decision value with detection temperature higher than the 1st decision value of the above.
[0053] The current controller 46 passes the current corresponding to this control signal among the both-ends children of Peltier device 40, when a control signal is inputted from the above-mentioned temperature data analysis section 44. That is, this current controller 46 is constituted so that such a big current that that temperature is high when the above-mentioned detection temperature is more than fixed may be passed among the both-ends children of Peltier device 40. Moreover, when a control signal is inputted from the above-mentioned temperature data analysis section 44, the warning command section 48 outputs a command signal to the warning means of the figure abbreviation prepared in the electric junction box exterior, and it is constituted so that it may be made to warn.
[0054] If generation of heat of FET18 becomes remarkable, since according to such a configuration between the both-ends children of Peltier device 40 will energize, Peltier device 40 will operate and the compulsory heat transfer from FET18 to a heat sink 40 will be caused, the heat dissipation to the open air which leads a heat sink 24 from FET18 by this is promoted, and the extremes-of-temperature rise of FET18 is avoided. moreover, since actuation of Peltier device 40 is suspended when the temperature of FET18 is comparatively low, it is based on the supercooling of FET18 -- being also inconvenient (for example, generating of dew condensation) -- it can protect.
[0055] In addition, you may make it the temperature set as the object of detection detect not only exoergic temperature of the above own [FET18] but its ambient temperature, and the temperature of the gate splicing fitting 20 in the gestalt of this operation. Moreover, the temperature of the elevated-temperature side face (drawing 11 drawing 10 and left lateral) of Peltier device 40 is detected, and if energization of Peltier device 40 is stopped when this temperature rises too much, failure of Peltier device 40 self can also be prevented.
[0056] Moreover, you may make it make Peltier device 40 intervene, respectively between both the connectors 16 shown with the gestalt of said 3rd operation, and the both ends of a heat sink 38, as the connector 16 which can introduce this Peltier device 40 is not restricted to what was shown in the gestalt of said 1st operation, for example, is shown in drawing 13 as a gestalt of the 5th operation.
[0057] The gestalt of the 6th operation is shown in drawing 14 (a) and (b). With the gestalt of this operation, although said each operation gestalt showed what used the connector 16 incorporating this for connection within an electric junction box, using FET as a control device, while using the connector 16 which incorporated IPS (Intelligent Power Switch) as a control device, there is nothing in an electric junction box then, direct continuation of this connector 16 is carried out to a power source and a load, and it is made to perform that flow control.
[0058] Above IPS has the power section 60 and the intelligent section 62. In the power section 60, the switching element which consists of FET etc., an internal electrical power source, a thermo-sensitive device, etc. are incorporated. The intelligent section 62 consisted of logical circuits etc., and is equipped with the function to judge the existence of abnormalities based on detecting signals, such as the above-mentioned thermo-sensitive device, the function to perform on-off control of the above-mentioned switching element based on the command inputted from an external control circuit, etc.
[0059] A grounding terminal 63, the input terminal 64 into which the above-mentioned command is inputted, and the diagnostic-output terminal 65 for outputting an abnormality diagnostic signal to the above-mentioned control circuit are formed in the intelligent section 62, and these terminals are equipped with splicing fitting 68. On the other hand, a power supply terminal 67 and an output terminal 66 are formed in the above-mentioned power section 60, a power supply terminal 67 is equipped with splicing fitting 77, and the output terminal 66 is equipped with splicing fitting 76.

And mold shaping of the connector housing 70 is carried out on the outside that these whole should be unified, and the connector 16 is constituted. While the above-mentioned input terminal 64 and the diagnostic-output terminal 65 are connected to the above-mentioned control circuit through splicing fitting (2nd connection member) 68, respectively A power supply terminal 67 is connected to a power source through splicing fitting (1st connection member) 77, and the output terminal 66 is connected to the load through splicing fitting (1st connection member) 76.

[0060] Even if it uses such a connector 16, energization between power-source-loads can be turned on and off by actuation of IPS which is a control device, and actuation of this IPS can be controlled by the control circuit. And efficient heat dissipation can be performed by making IPS estrange from this control circuit by being able to protect the circuit element of a control circuit and exposing the power supply terminal 67 of Above IPS on the external surface of the connector housing 70. Furthermore, the heat dissipation effectiveness can be heightened by introducing a heat sink and a suitable cooling component like the above.

[0061] Moreover, when Above IPS builds in two or more switching elements (i.e., as shown in drawing 15 (a) and (b) as a gestalt of the 7th operation, also when it has two or more input terminals 64 and output terminals 66), the connector 16 with which the whole was united like the gestalt of implementation of said 6th operation can be constituted.

[0062] In addition, you may make it the connector of this invention connect the 1st [as shown in said drawing 2 , not only when carrying out direct continuation to the bus bar substrate 13 and the electronic-circuitry substrate 14, but] connection member to a current circuit through an electric wire, and may make it connect the 2nd connection member to a control circuit through an electric wire. For example, you may make it connect to splicing fitting 68 and splicing fitting 76 and 77 the cable terminal and connector which were prepared in the terminal of the above-mentioned electric wire in the case of the connector 16 shown in drawing 14 (a) and (b).

[0063] Thus, since the arrangement location of a connector can be freely set to the structure which connected the connector of this invention to the current circuit and the control circuit through the electric wire, respectively, when heat dissipation of the electron device inserted especially in the interior of a connector is remarkable, the advantage which can prevent the thermal run away of the above-mentioned electron device is acquired by installing only a part for a connector area in the location where environmental temperature is low.

[0064] On the other hand, if the wiring gestalt which carries out direct continuation of the 1st connection member of the connector of this invention to the load or power supply terminal, and connects the 2nd connection member of the connector of this invention to a current circuit side through an electric wire at a control circuit side is taken It is possible to be able to carry out [shortest]-izing of the path for which it flows, the path, i.e., the high current, between a current circuit and the connector of this invention, to abolish the need of arranging the large diameter electric wire for high currents on this path, and to reduce cost remarkably, making a current circuit estrange greatly from the above-mentioned control circuit comparatively weak with heat. Moreover, the noise which comes out of the above-mentioned high current path can be prevented using the minimum cutoff ingredient.

[0065] Moreover, conversely, to a current circuit, the 1st connection member of the connector of this invention is connected through an electric wire, and when it can be made to carry out to the connector for substrates of the circuit board in which the control circuit was included etc. direct continuation of the 2nd connection member, the advantage which can combine the connector of this invention with the above-mentioned connector for substrates etc. easily is acquired, making a control circuit and a current circuit estrange greatly. Moreover, since a high current does not flow the above-mentioned circuit board top, the temperature rise of the substrate concerned and generating of a radiation noise can be prevented, and the advantage which can prevent malfunction of the control circuit included in this substrate is acquired.

[0066] Although various methods of manufacturing a connector 16 in this invention are considered, the example is shown in drawing 16 (a) - (c).

[0067] First, as shown in drawing 16 (a), while manufacturing what equipped the power section 60 of IPS with the power supply terminal 67 and the output terminal 66, as shown in this drawing (b), mold shaping of the connector housing 72 with which the splicing fitting 73 for grounding terminals, the splicing fitting 74 for diagnostic-output terminals, and the splicing fitting 75 for input terminals were fixed is carried out, and what was shown by said drawing 16 (a) is fixed to crevice 72a formed in this connector housing 72. next, it is shown in this drawing (c) -- as -- each terminal of the power section 60 -- each above-mentioned splicing fitting 73, 74, and 75 -- a wire 78 -- minding -- connecting (that is, it connecting by wirebonding etc.) -- a power supply terminal 67 and an output terminal 66 are

equipped with splicing fitting 77 and 76, respectively. And a connector can be completed by covering a connection part with the above-mentioned wire 78 by resin mold etc. at least, and putting a lid on the connector housing 72 from a top if needed.
[0068] This invention can also take the following gestalten as an example besides the gestalt of the above-mentioned operation.
[0069] (1) In the gestalt of said 1st operation etc., it is also possible to interpose between both the substrates 13 and 14 comrades in the condition of having omitted the connector housing 26 and having made the full exposure of FET18 carrying out outside. The heat dissipation effectiveness can be promoted by connecting the radiator material of heat sink 24 grade with the radiator of FET18 also in this case, or making Peltier device 40 intervene between this radiator material and FET18. However, like said each operation gestalt, if the above FET 18 is unified as a single connector 16 with each splicing fitting 20-22, the advantage which can carry out [easy]-izing of the assembly operation of the electric junction box 10 whole will be acquired.
[0070] (2) In addition to this, the control device in this invention can apply IGBT (Insulated Gate Bipolar Transistor), BPT (Bipolar Transistor), various regulators, a power module, etc. not only in the above [FET or IPS] 18. However, if the control device with which a control terminal (the example of drawing gate terminal 30) and an energization terminal (the example of drawing the drain terminal 31 and the source terminal 32) project in an opposite side mutually is used as shown in said each operation gestalt The advantage which can simplify connection structure is acquired by interposing this control device between both the substrates 13 and 14 in the condition that the above-mentioned energization terminal turns to the above-mentioned bus bar substrate 13 side (the example of drawing under), and a control terminal turns to the electronic-circuitry substrate 14 side (above).
[0071] (3) The 1st circuit board in this invention can apply the various circuit boards by which the conductor was built into the substrate which consists not only of the above bus bar substrates 13 but of an insulating material.
[0072]
[Effect of the Invention] A control device for this invention to control the current which flows a current circuit as mentioned above, The 1st connection member for connecting this control device to the above-mentioned current circuit, Since it is the connector which incorporated at one the 2nd connection member for connecting the above-mentioned control device to the control circuit which controls actuation of this device in connector housing It is effective in the ability to protect other electron devices which constitute the above-mentioned control circuit from heat dissipation of a control device, controlling the current in a current circuit by connecting this connector to the above-mentioned current circuit and a control circuit.
[0073] And by forming a radiator in the control device of this connector, and exposing this radiator to the exterior of the above-mentioned connector housing, the heat which a control device emits can be radiated efficiently and the effectiveness that that fault temperature up can be prevented is acquired.
[0074] Moreover, the heat dissipation effectiveness can be made still more remarkable by connecting with the radiator concerned the radiator material which has bigger surface area than the radiator of the above-mentioned control device, and exposing this radiator material to the exterior of the above-mentioned connector housing.
[0075] Furthermore, according to the thing between which the cooling component which cools a radiator by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator between the above-mentioned radiator material and a radiator was made to be placed, the effectiveness that the heat dissipation from a radiator can be promoted positively is acquired.
[0076] Furthermore, the effectiveness which can control actuation of a cooling component using this control circuit is acquired by connecting a cooling component and a control circuit to the above-mentioned connector housing through this connection member for cooling according to what included in one the connection member for cooling which connects the above-mentioned cooling component to the control circuit of the 2nd circuit board of the above.
[0077] Moreover, according to that the connection member of the above 1st and the 2nd connection member have turned [that] to the opposite direction mutually, the activity which connects a control device to the both sides of a current circuit and a control circuit is done easy, and the effectiveness which can also simplify wiring structure is acquired.
[0078] Furthermore, the effectiveness which can be avoided more certainly is acquired [that energization terminals short-circuit and] by making the separator which consists of an insulating material intervene among the above-mentioned energization terminals.

[0079] Moreover, while this invention is equipped with the 1st circuit board in which the current circuit was included, the control device for controlling the current which flows the above-mentioned current circuit, and the 2nd circuit board in which the control circuit which controls actuation of this control device was included Since it is the electric junction box which arranged the above-mentioned control device in the location between the 1st circuit board of the above, and the 2nd circuit board While promoting heat dissipation of a control device and being able to secure that good actuation compared with structure conventionally by which this control device is mounted on the 2nd circuit board, it is effective in the ability to prevent that the heat released out of this control device has a bad influence on the electron device of the 2nd circuit board etc. Moreover, although a control device is arranged on the location between both substrates, it is not necessary to enlarge the whole electric junction box specially, and the above-mentioned effectiveness is acquired with compact structure, and-izing also of the connection between a control device and both substrates can be carried out [easy].

[0080] especially -- the 1st circuit board of the above, and the 2nd circuit board -- abbreviation -- as the above-mentioned control device, when making it estrange mutually and arranging in the parallel condition If that to which the control terminal connected with two or more energization terminals connected to the current circuit of the 1st circuit board of the above in the control circuit of the 2nd circuit board of the above projects in the opposite direction mutually is used The effectiveness which can simplify connection with the circuit included in each terminal and each substrate of this control device is acquired by arranging a control device among both substrates, where it turned that energization terminal to the circuit board side of the above 1st and the above-mentioned control terminal is turned to the circuit board side of the above 2nd.

[0081] Moreover, if radiator material with larger surface area than this radiator is connected with the radiator of the above-mentioned control device, the effectiveness which can promote the heat dissipation from this control device further will be acquired.

[0082] While installing two or more control devices between the 1st circuit board of the above, and the 2nd circuit board According to what connected with the radiator of these control device the common radiator material prolonged in the 2nd circuit board of the above, and abbreviation parallel While being able to introduce the radiator material of a large area, without making the whole electric junction box enlarge and being able to promote the part heat dissipation operation further, using effectively the space inserted into both substrates, the effectiveness which can also reduce components mark is acquired. Furthermore, since the above-mentioned radiator material will be in a wrap condition from one side about the 2nd circuit board of the above, the effectiveness that the control circuit in the 2nd circuit board can be effectively protected from an electromagnetic wave is also acquired by making this radiator material serve a double purpose as shielding material of the 2nd circuit board.

[0083] If a cooling component is made to intervene between the above-mentioned radiator material and the radiator of the above-mentioned control device and it is made to carry out heat transfer compulsorily towards radiator material from the above-mentioned radiator, the heat dissipation from a radiator will be promoted further and the effectiveness that the fault temperature up of a control device can be prevented still more certainly will be acquired.

[0084] Furthermore, if the cooling control section which controls actuation of the above-mentioned cooling component based on the temperature detected by this temperature detection means is included in the 2nd circuit board of the above while having a temperature detection means to detect the temperature of the above-mentioned control device, or the temperature corresponding to this, the effectiveness which can perform proper temperature control which balanced the actual condition, using this control circuit effectively will be acquired.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the decomposition perspective view showing the whole electric junction box structure in the gestalt of operation of the 1st of this invention.
[Drawing 2] a part of connector prepared in the above-mentioned electric junction box -- it is a cross-section side elevation.
[Drawing 3] It is the front view of the above-mentioned connector.
[Drawing 4] It is the A-A line sectional view of drawing 3 .
[Drawing 5] It is the decomposition perspective view of each part article incorporated in connector housing of the above-mentioned connector.
[Drawing 6] It is the assembly perspective view of each part article incorporated in connector housing of the above-mentioned connector.
[Drawing 7] The side elevation of this FET and (c of the rear view of FET where (a) is included in the above-mentioned connector, and (b)) are the front views of this FET.
[Drawing 8] a part of connector of the electric junction box in the gestalt of operation of the 2nd of this invention -- it is a cross-section side elevation.
[Drawing 9] It is the side elevation showing the important section of the electric junction box in the gestalt of operation of the 3rd of this invention.
[Drawing 10] a part of connector of the electric junction box in the gestalt of operation of the 4th of this invention -- it is a cross-section side elevation.
[Drawing 11] It is the top view of the connector of drawing 10 .
[Drawing 12] It is the block diagram showing the functional configuration of the control circuit included in an electronic-circuitry substrate in the gestalt of said 4th operation.
[Drawing 13] It is the side elevation showing the important section of the electric junction box in the gestalt of operation of the 5th of this invention.
[Drawing 14] The top view of a connector [in / in (a) / the gestalt of operation of the 6th of this invention] and (b) are the bottom views of this connector.
[Drawing 15] The top view of a connector [in / in (a) / the gestalt of operation of the 7th of this invention] and (b) are the bottom views of this connector.
[Drawing 16] (a) - (c) shows an example of the production process of the connector of this invention -- it is a cross-section perspective view a part.
[Drawing 17] It is the perspective view showing an example of the internal structure of the conventional electric junction box.
[Description of Notations]
10 Electric Junction Box
13 Bus Bar Substrate (1st Circuit Board)
14 Electronic-Circuitry Substrate (2nd Circuit Board)
16 Connector
18 FET (Control Device)
20 Gate Splicing Fitting (2nd Connection Member)

21 Drain Splicing Fitting (1st Connection Member)
22 Source Splicing Fitting (1st Connection Member)
24 38 Heat sink (radiator material)
26, 70, 72 Connector housing
28 Semiconductor Chip (FET Body)
30 Gate Terminal (Control Terminal)
31 Drain Terminal (Energization Terminal)
32 Source Terminal (Energization Terminal)
36 Separator
40 Peltier Device (Cooling Component)
42 Temperature Sensor (Temperature Detection Means)
44 Temperature Data Analysis Section (Cooling Control Section is Constituted)
46 Current Controller (Cooling Control Section is Constituted)
50A, 50B Splicing fitting for cooling (connection member for cooling)
60 Body Chip 68 (Control Device is Constituted)
 Splicing Fitting (2nd Connection Member)
76 77 Splicing fitting (1st connection member)

[Translation done.]

* NOTICES *

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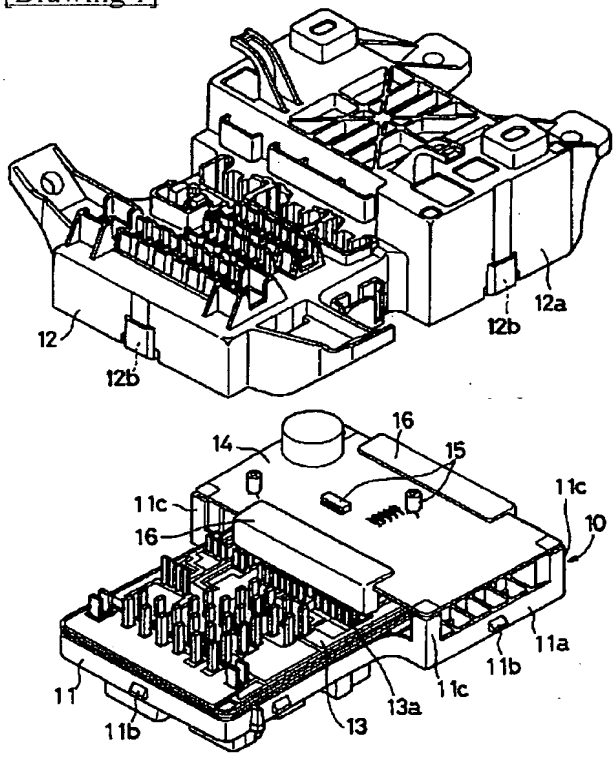
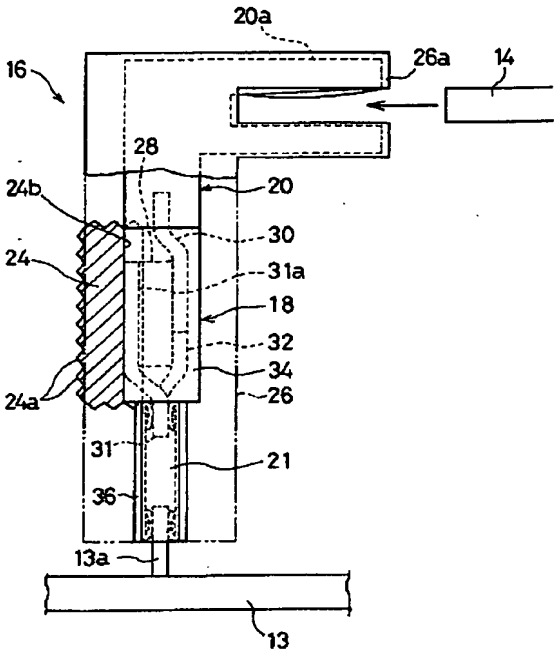
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

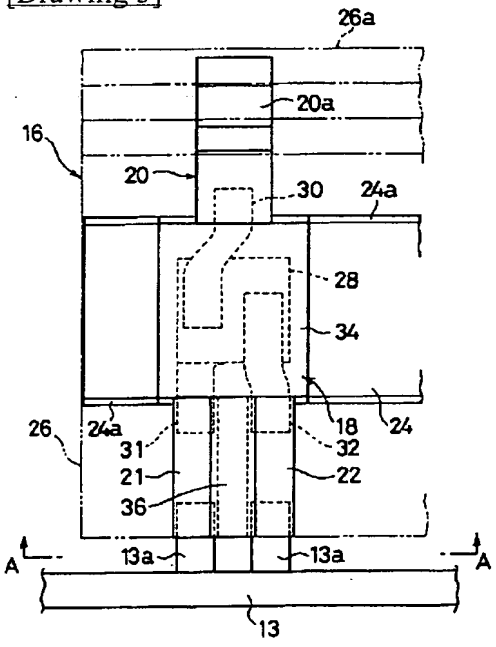
[Drawing 1]



[Drawing 2]



[Drawing 3]



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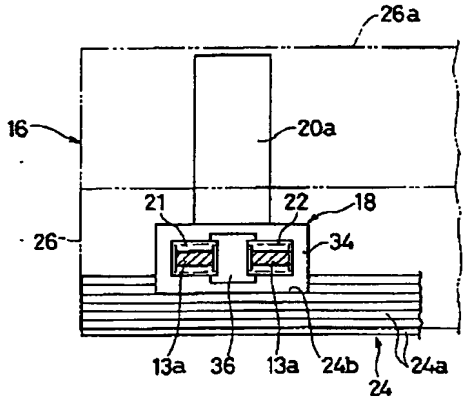
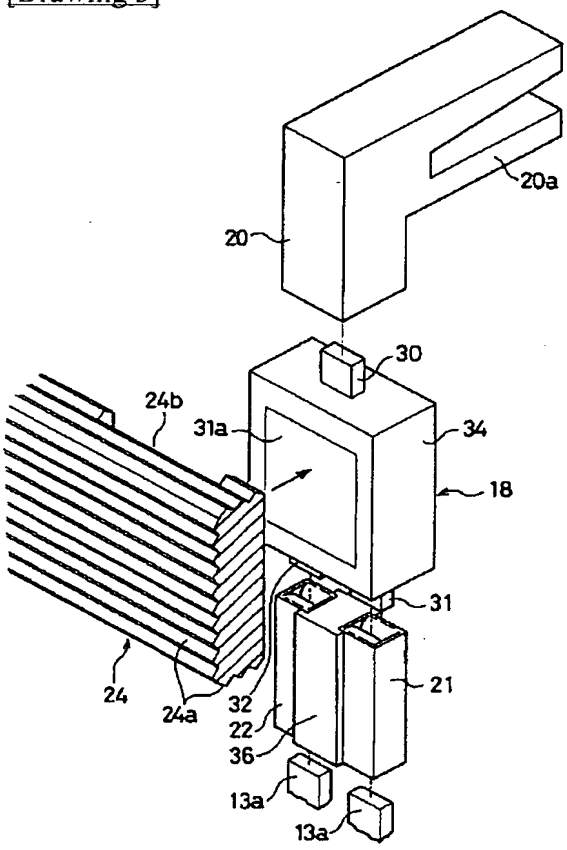


[Drawing 5]



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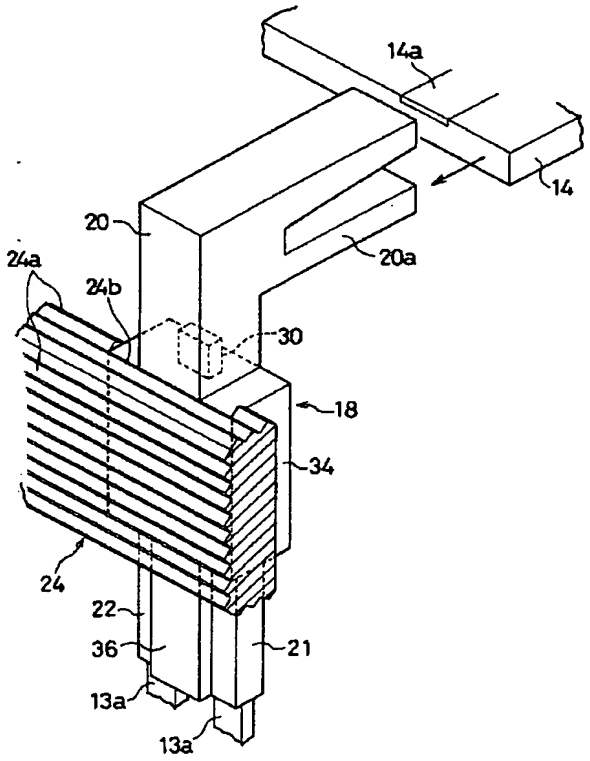

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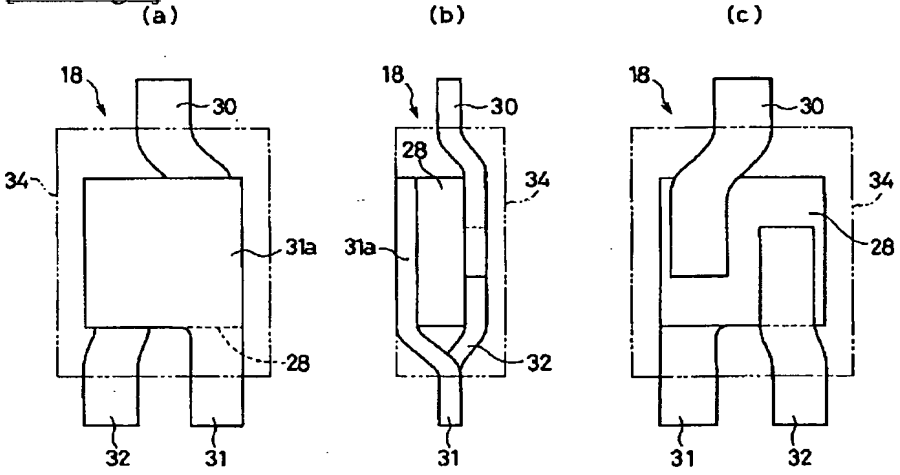

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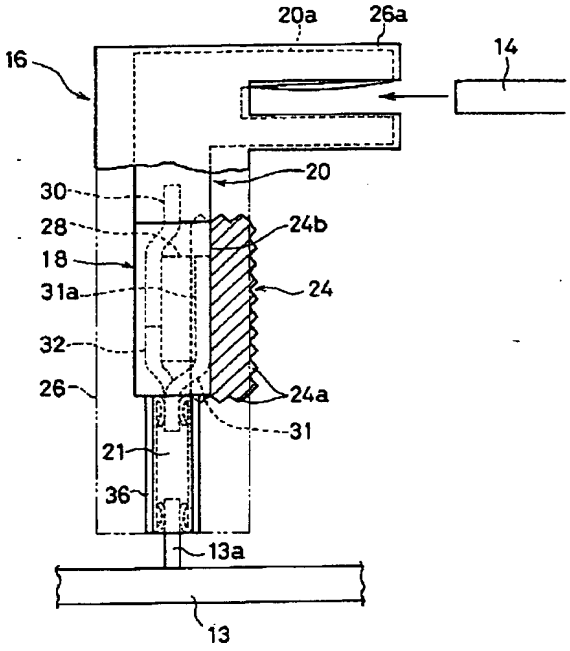

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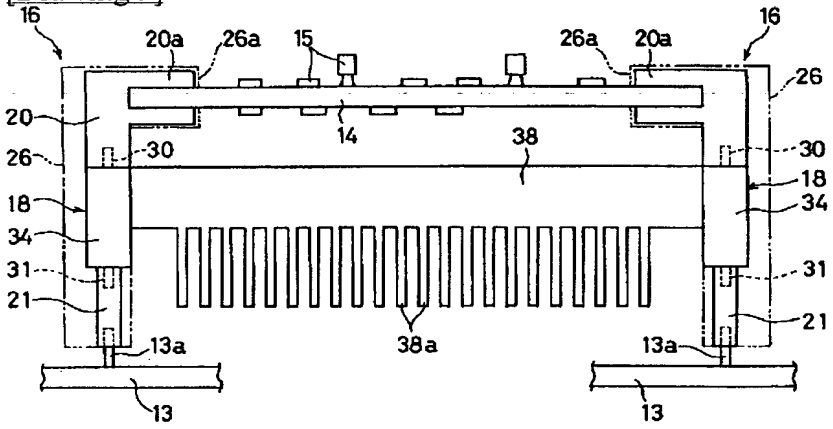
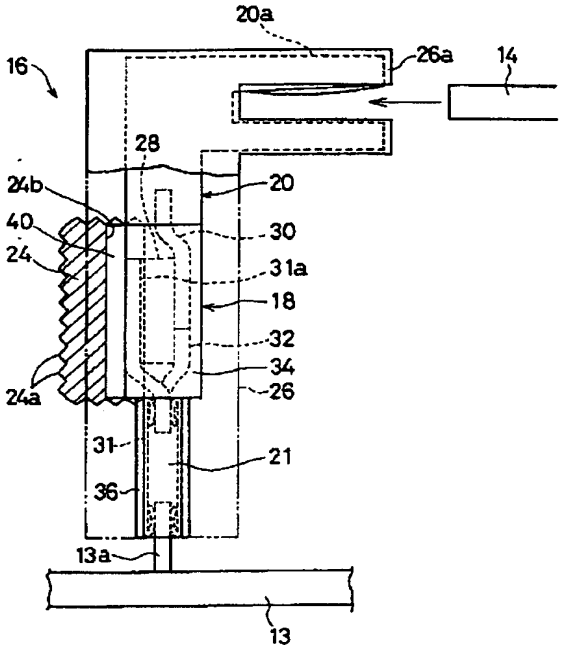
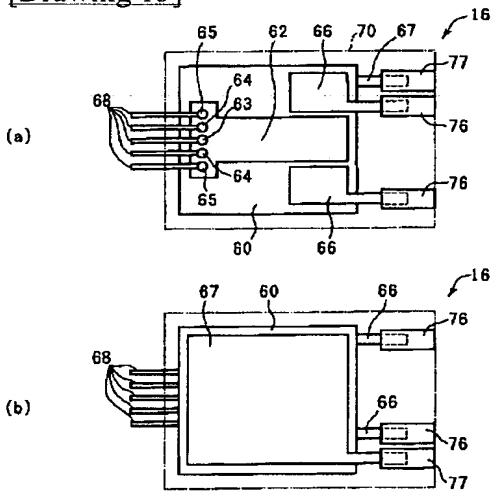


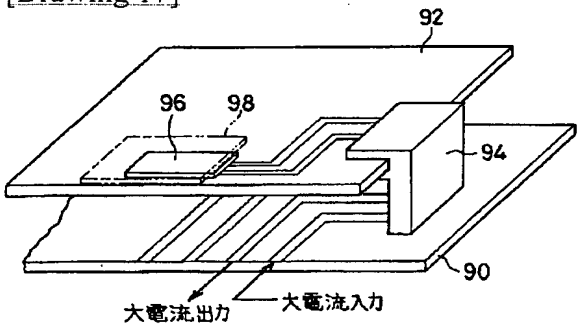
[Drawing 10]



[Drawing 15]



[Drawing 17]



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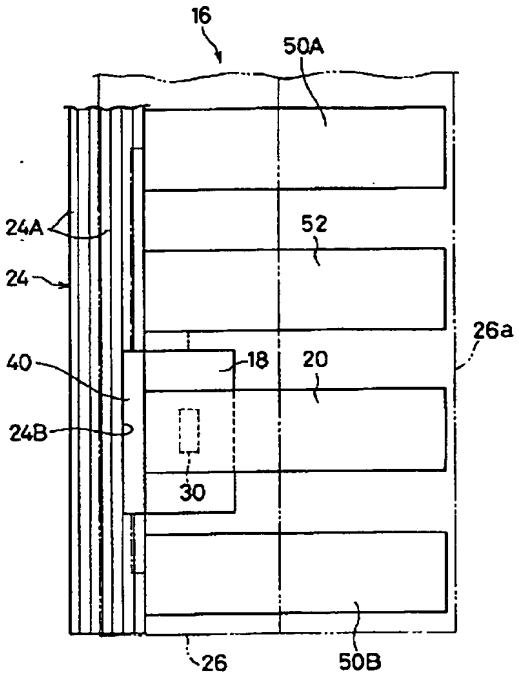

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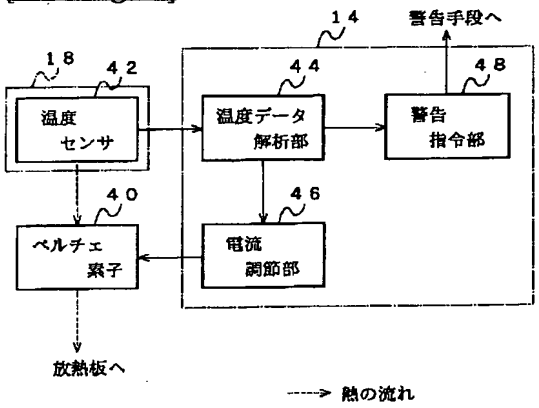
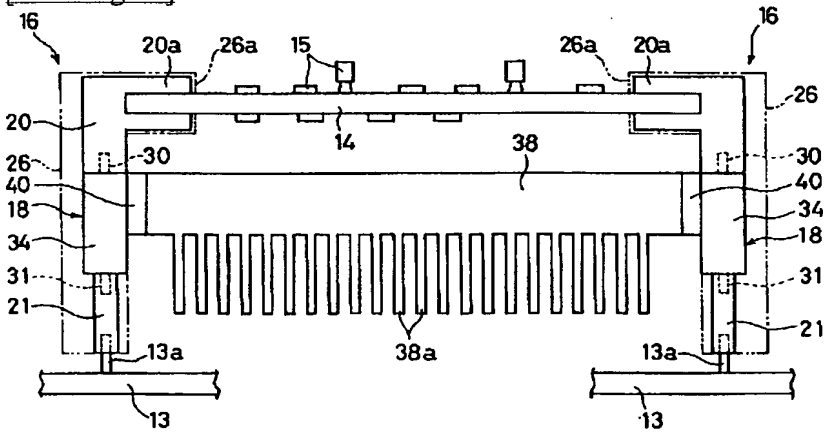
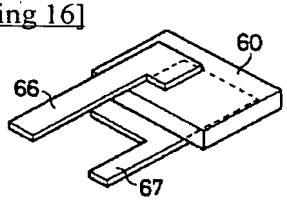


[Drawing 13]

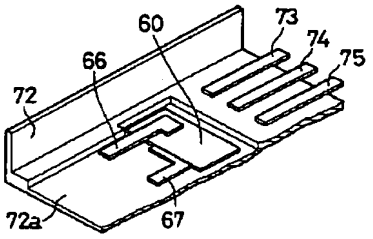


[Drawing 16]

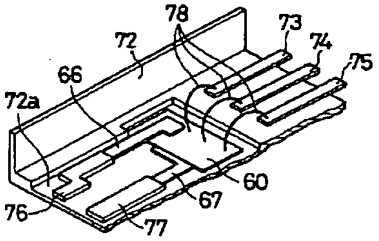
(a)



(b)

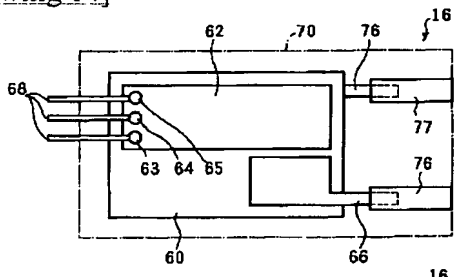


(c)



[Drawing 14]

(a)



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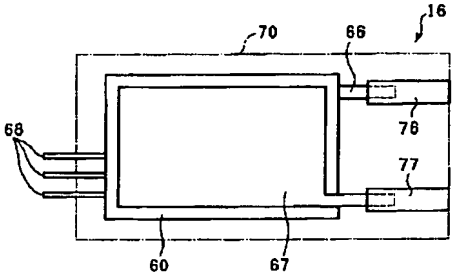

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		６２１				６２１Ｊ	
Ｈ０１Ｒ	13/533		7815－5Ｂ	Ｈ０１Ｒ	13/533	Ａ	
	13/66		9173－5Ｂ		13/66		
	23/68	３０３	7815－5Ｂ		23/68	３０３Ｃ	

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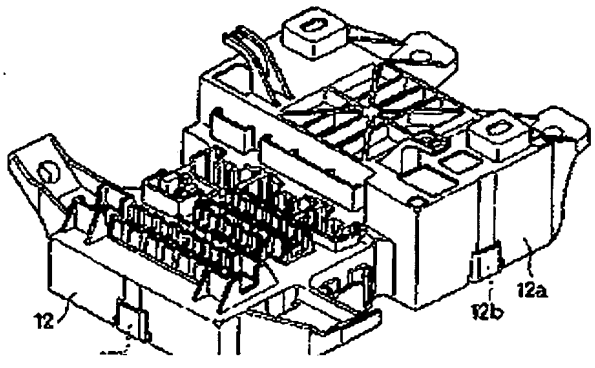
(54)【発明の名称】　コネクタ及び電気接続箱

(57)【要約】

【課題】　電気接続箱等に設けられる制御デバイスの放熱から他の電子デバイスを有効に保護する。

【解決手段】　バスバー基板１３と、その電流回路の電流を制御するＦＥＴ１８と、このＦＥＴ１８の作動を制御する電子回路基板１４とを備え、上記ＦＥＴ１８を両基板１３，１４の間に配設した電気接続箱。また、両基板１３，１４同士の間に介設されるコネクタ１６であって、上記ＦＥＴ１８と、そのドレイン端子３１等を上記バスバー基板１３に接続するためのドレイン接続金具２



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【特許請求の範囲】

【請求項１】　電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスを上記電流回路に接続するための第１の接続部材と、上記制御デバイスをこのデバイスの作動を制御する制御回路に接続するための第２の接続部材とをコネクタハウジング内に一体に組み込んだことを特徴とするコネクタ。

【請求項２】　請求項１記載のコネクタにおいて、上記制御デバイスに放熱部を設け、この放熱部を上記コネクタハウジングの外部に露出させたことを特徴とするコネクタ。

【請求項３】　請求項１記載のコネクタにおいて、上記制御デバイスに放熱部を設け、この放熱部よりも大きな表面積を有する放熱部材を当該放熱部に連結し、かつ、この放熱部材を上記コネクタハウジングの外部に露出させたことを特徴とするコネクタ。

【請求項４】　請求項３記載のコネクタにおいて、上記制御デバイスの放熱部と上記放熱部材との間に上記放熱部から放熱部材に向けて強制的に熱移動させることにより上記放熱部を冷却する冷却素子を介在させたことを特徴とするコネクタ。

【請求項５】　請求項４記載のコネクタにおいて、上記コネクタハウジングに、上記冷却素子を上記第２の回路基板の制御回路に接続する冷却用接続部材を一体に組み込んだことを特徴とするコネクタ。

【請求項６】　請求項１～５のいずれかに記載のコネクタにおいて、上記第１の接続部材と第２の接続部材とが互いに反対の方向を向いていることを特徴とするコネクタ。

【請求項７】　請求項６記載のコネクタにおいて、複数の第１の接続部材同士の間に絶縁材料からなるセパレータを介在させたことを特徴とするコネクタ。

【請求項８】　電流回路が組み込まれた第１の回路基板と、上記電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスの作動を制御する制御回路が組み込まれた第２の回路基板とを備えるとともに、上記第１の回路基板と第２の回路基板との間の位置に上記制御デバイスを配設したことを特徴とする電気接続箱。

【請求項９】　請求項８記載の電気接続箱において、上記第１の回路基板と第２の回路基板とを略平行な状態で

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気接続箱。

【請求項１１】　請求項１０記載の電気接続箱において、上記第１の回路基板と第２の回路基板との間に複数の制御デバイスを並設するとともに、これらの制御デバイスの放熱部に上記第２の回路基板と略平行に延びる共通の放熱部材を連結したことを特徴とする電気接続箱。

【請求項１２】　請求項１０または１１記載の電気接続箱において、上記制御デバイスの放熱部と上記放熱部材との間に上記放熱部から放熱部材に向けて強制的に熱移動させることにより放熱部を冷却する冷却素子を介在させたことを特徴とする電気接続箱。

【請求項１３】　請求項１２記載の電気接続箱において、上記制御デバイスの温度もしくはこれに対応する温度を検出する温度検出手段を備えるとともに、この温度検出手段により検出された温度に基づいて上記冷却素子の作動を制御する冷却制御部を上記第２の回路基板に組み込んだことを特徴とする電気接続箱。

【請求項１４】　電流回路が組み込まれた第１の回路基板と、上記電流回路を流れる電流を制御するための制御デバイスが組み込まれた請求項１～７のいずれかに記載のコネクタと、上記制御デバイスの作動を制御する制御回路が組み込まれた第２の回路基板とを備え、上記コネクタの第１の接続部材に上記電流回路を接続し、上記コネクタの第２の接続部材に上記制御回路を接続したことを特徴とする電気接続箱。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、自動車用ワイヤーハーネス等に用いられるコネクタ及び電気接続箱に関するものである。

【０００２】

【従来の技術】従来の電気接続箱における回路構成の一例を図１７に示す。図において、バスバー基板（第１の回路基板）９０と電子回路基板（第２の回路基板）９２とが略平行に配せられ、両基板９０、９２同士の間にコネクタ９４が介設されている。

【０００３】バスバー基板９０に組み込まれているバスバー回路（電流回路）には、図略の電線等を介して電源回路等が接続され、このバスバー回路に比較的大きな電流が流されるようになっている。電子回路基板９２上に

が流されるが．この電流は．電子回路基板９２の制御回路を流れる電流に比べて著しく大きく．よってＦＥＴ９６の発熱量は同じ電子回路基板９２上に実装されている電子デバイスに比べて非常に大きくなる。そこで従来は．このＦＥＴ９６を効果的に冷却すべく、ＦＥＴ９６の表面に通電端子の一部を露出させる等して放熱部を形成するとともに．この放熱部に図示のような比較的大面積の放熱板９８を連結するといった手段がとられている。

【０００５】

【発明が解決しようとする課題】上記構成では．ＦＥＴ９６が回路基板９２上に直接実装されているため．ＦＥＴ９６から放たれた熱が同じ電子回路基板９２上に実装された他の電子デバイスに伝わり、これらのデバイスの作動に悪影響を及ぼすおそれがある。

【０００６】本発明は、このような事情に鑑み．ＦＥＴをはじめとする制御デバイスの放熱から他の電子デバイスを有効に保護できるコネクタ及び電気接続箱を提供することを目的とする。

【０００７】

【課題を解決するための手段】上記課題を解決するための手段として．本発明は．電流回路を流れる電流を制御するための制御デバイスと．この制御デバイスを上記電流回路に接続するための第１の接続部材と．上記制御デバイスをこのデバイスの作動を制御する制御回路に接続するための第２の接続部材とをコネクタハウジング内に一体に組み込んだものである。

【０００８】このコネクタによれば．その制御デバイスを第１の接続部材を介して電流回路に接続するとともに．上記制御デバイスを第２の接続部材を介して制御回路に接続することにより．この制御回路で制御デバイスの作動を制御しながら、この制御デバイスによって電流回路の電流を制御できる。この状態では、上記制御デバイスが上記制御回路から離れた位置にあるため．従来のように上記制御デバイスを制御基板上に実装している構造と異なり、制御デバイスから放たれた熱が上記制御基板上の他の電子デバイス等に直接伝えられることが防がれる。

【０００９】このコネクタにおいて．上記制御デバイスに放熱部を設け　この放熱部を上記コネクタハウジング

ら放熱部材に向けて強制的に熱移動させることにより放熱部を冷却する冷却素子を介在させれば、放熱部からの放熱をさらに促進させることができる。

【００１２】さらに、上記コネクタハウジングに．上記冷却素子を上記第２の回路基板の制御回路に接続する冷却用接続部材を一体に組み込み、この冷却用接続部材を介して冷却素子と制御回路とが接続されるようにすれば．この制御回路を利用して冷却素子の作動を制御するといったこともできる。

【００１３】上記第１の接続部材と第２の接続部材とは．これらが互いに反対の方向を向いているのが好ましい。これにより．制御デバイスを電流回路と制御回路の双方に接続する作業が容易になり、配線構造も簡単になる。

【００１４】その際、上記通電端子同士の間に絶縁材料からなるセパレータを介在させることにより、通電端子同士が短絡されるのをより確実に回避できる。

【００１５】また本発明は．電流回路が組み込まれた第１の回路基板と．上記電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスの作動を制御する制御回路が組み込まれた第２の回路基板とを備えるとともに、上記第１の回路基板と第２の回路基板との間の位置に上記制御デバイスを配設した電気接続箱である。

【００１６】この構成において、半導体デバイスは両基板同士の間に配設されているので、この半導体デバイスが第２の回路基板上に実装されている従来構造に比べて半導体デバイスから放熱され易く、その過昇温が避けられる。また、この半導体デバイスから放たれた熱が第２の回路基板の電子デバイス等に直接伝えられるのも防ぐことができる。しかも、半導体デバイスは、元来．相互離間している両基板間に配設されているため、電気接続箱全体を大型化する必要がなく、また．半導体デバイスと両基板との接続も容易である。

【００１７】特に、上記第１の回路基板と第２の回路基板とを略平行な状態で互いに離間させて配置する場合、上記半導体デバイスとして．上記第１の回路基板の電流回路に接続される複数の通電端子と上記第２の回路基板の制御回路に接続される制御端子とが互いに反対の方向に突出するものを用いれば．その通電端子を上記第１の

の半導体デバイスを並設するとともに．これら半導体デバイスの放熱部に上記第２の回路基板と略平行に延びる共通の放熱部材を連結すれば、両基板に挟まれた空間を有効に利用して．電気接続箱全体を大型化させずに大面積の放熱部材を導入でき．その分放熱作用をさらに促進できる。また．共通の放熱部材で複数の半導体デバイスの放熱を促進できるため．各半導体デバイスごとに放熱部材を配する場合に比べ．部品点数も削減される。さらに．上記放熱部材が上記第２の回路基板を片側から覆う状態となるため．この放熱部材を第２の回路基板のシールド材として兼用することも可能になる。

【００２０】上記放熱部材は上記半導体デバイスの放熱部に直接接触させてもよいが、これらの間に上記放熱部から放熱部材に向けて強制的に熱移動させることにより放熱部を冷却する冷却素子を介在させれば、放熱部からの放熱をさらに促進させることができる。

【００２１】ここで、半導体デバイスの冷却が不要な時（例えば非作動時）に冷却素子が作動する等して半導体デバイスが過冷却されると．この半導体デバイスの表面に結露が発生するといった不都合が生じ得るが．上記冷却素子がペルチェ素子のように外部からの供給電流等によって作動制御が可能な素子である場合、上記半導体デバイスの温度もしくはこれに対応する温度を検出する温度検出手段を備えるとともに、この温度検出手段により検出された温度に基づいて上記冷却素子の作動を制御する冷却制御部を上記第２の回路基板に組み込むことにより．実状に見合った適正な温度制御ができる。

【００２２】上記半導体デバイスは．単独で両基板間に配するようにしてもよいが．前記各コネクタを用いる、すなわち、このコネクタの第１の接続部材に上記電流回路を接続し、上記コネクタの第２の接続部材に上記制御回路を接続することにより．電気接続箱全体の組立作業が容易になる。

【００２３】

【発明の実施の形態】本発明の第１の実施の形態を図１～図７に基づいて説明する。

【００２４】図１に示す電気接続箱１０は、ロアケース１１とアッパーケース１２とを備えている。ロアケース１１の側壁１１ａには係合部１１ｂが形成され．アッパーケース１２の側壁１２ａには係合部１２ｂが形成され

【００２６】ロアケース１１の周縁部には、上記バスバー基板１３よりもさらに上方に突出する複数の支柱１１ｃが立設され．これらの支柱１１ｃによって電子回路基板１４が支持されている。すなわち．この電子回路基板１４は、上記バスバー基板１３と略平行な状態で．このバスバー基板から上方に離間した位置に支持されている。この電子回路基板１４には、多数の電子デバイス１５が実装されており、これらの電子デバイス１５によって．後述のＦＥＴ１８にゲート信号を入力する制御回路が構成されている。

【００２７】そして、この電子回路基板１４と上記バスバー基板１３との間に、図２～図６に示すようなコネクタ１６が介設されている。このコネクタ１６は．制御デバイスである上記ＦＥＴ１８と、ゲート接続金具（第２の接続部材）２０と、ドレイン接続金具（第１の接続部材）２１と、ソース接続金具（第２の接続部材）２２と．放熱板２４とを備え．これら全体がモールド成形によって樹脂製のコネクタハウジング２６に一体に組み込まれている。

【００２８】コネクタハウジング２６は、電子回路基板１４の周縁部と平行に延び．その上端部は電子回路基板１４側に屈曲している。そして、この屈曲部分に．上記電子回路基板１４の周縁部が側方から差し込み可能な二股状のクリップ部２６ａが形成されている。

【００２９】ＦＥＴ１８は．図７（ａ）～（ｃ）に示すように、ＦＥＴ本体である半導体チップ２８と．ゲート端子（制御端子）３０と．ドレイン端子（通電端子）３１と．ソース端子（通電端子）３２とが樹脂製のハウジング３４でカバーされたものであり．モールド成形等によって製造が可能である。

【００３０】上記ゲート端子３０及びソース端子３２は．上記半導体チップ２８において同じ側の側面（図７（ｂ）では右側面）に接合されており．これと反対側の側面に上記ドレイン端子３１が接続されている。このドレイン端子３１において上記側面に接合される部分は、当該側面と同等の面積を有する放熱部３１ａとされており．この放熱部３１ａが上記ハウジング３４の側面に露出している。

【００３１】さらに、このＦＥＴ１８の特徴として、上記３つの端子３０～３２のうち．ゲート端子３０のみが

同様．上記電子回路基板１４の周縁部を上下から挟持可能な（すなわち電子回路基板１４が側方から差し込み可能な）二股状のクリップ部２０ａが形成されている。そして．このクリップ２０ａが電子回路基板１４の周縁部を挟持した状態で、この電子回路基板１４の制御回路を構成する導体部分１４ａが上記クリップ部２０ａと接触し．上記制御回路がゲート接続金具２０を介してＦＥＴ１８のゲート端子３０に電気的に接続されるようになっている。

【００３３】ドレイン接続金具２１及びソース接続金具２２は、互いに同一の形状．具体的には、上下に延び、その上下両端に雌型の係合部を有する形状をなしており．ドレイン接続金具２１の上端部に上記ＦＥＴ１８のドレイン端子３１の下端部が差し込まれ、ソース端子２２の上端部にソース端子３２の下端部が差し込まれている。

【００３４】両接続金具２１，２２同士の間には．絶縁体からなるセパレータ３６が介在している。これら接続金具２１，２２及びセパレータ３６は全体がモールド成形によって一体化されており、このセパレータ３６の介在によって両接続金具２１，２２同士の絶縁が確保されている。そして．両接続金具２１，２２の下端部に上記バスバー基板１３における適当なタブ１３ａが下方から差し込まれることにより．これらタブ１３ａが各接続金具２１，２２を介して上記ドレイン端子３１及びソース端子３２に個別に接続されるようになっている。すなわち．バスバー回路中にＦＥＴ１８が組み込まれるようになっている。

【００３５】放熱板２４は．アルミニウム等の導電性に優れた材料で成形され、コネクタハウジング２６と略同等の寸法まで水平に延びる形状を有している。そして、この放熱板２４の表面がコネクタハウジング２６の外側面（電子回路基板１４と反対側の側面；図２では右側面）に露出した状態で、この放熱板２４もコネクタハウジング２６に組み込まれている。この放熱板２４の表面には．水平に延びる多数の突条２４ａが形成されており．これにより放熱板２４の放熱面積が増やされている。

【００３６】この放熱板２４の内側面には凹部２４ｂが形成され．この凹部２４ｂにＦＥＴ１８のハウジング３

きな電流は、途中、図２～図６に示されるタブ１３ａ→ソース接続金具２２→ＦＥＴ１８のソース端子３２→半導体チップ２８→ドレイン端子３１→ドレイン接続金具２１→タブ１３ａの順に流れ、バスバー回路から出力される。一方、上記ＦＥＴ１８のゲート端子３０には、電子回路基板１４に組み込まれた制御回路からゲート接続金具２０を介してゲート信号が入力され、このゲート信号によって上記ＦＥＴ１８におけるソース－ドレイン間の通電量が制御される。

【００３９】このように．ＦＥＴ１８にはバスバー回路を流れる電流と同等の電流が流れるため、ＦＥＴ１８には発熱が起こる。ここで従来は、ＦＥＴ１８が他の電子デバイスとともに電子回路基板１４上に実装されていたため．たとえこのＦＥＴ１８に放熱板等を連結したとしても十分な放熱作用は得られにくく．また、このＦＥＴ１８の発する熱が他の電子デバイスに伝わってこれらの電子デバイスの性能にも悪影響を及ぼすおそれがあったが．図１～図７に示す電気接続箱１０では、ＦＥＴ１８がバスバー基板１３及び電子回路基板１４の双方から離れた状態で両基板１３，１４同士の間の位置に配されており．ＦＥＴ１８の放熱部３１ａと接触する放熱板２４がコネクタハウジング２６の外方に露出した状態にあるため．このＦＥＴ１８の放熱作用が高く、また．その放たれた熱が電子回路基板１４上の各電子デバイスに悪影響を与えるのを防ぐことができる。しかも、両基板１３、１４は元々互いに離間した状態で配置されるものであるので、これらの間にＦＥＴ１８を配設するのに電気接続箱１０を特に大型化する必要もない。

【００４０】第２の実施の形態を図８に示す。前記第１の実施の形態では、コネクタ１６の外側面にＦＥＴ１８の放熱部３１ａを向け、この放熱部３１ａに連結した放熱板２４を上記外側面に露出させているが、この第２の実施の形態では．上記放熱部３１ａをコネクタ１６の内側面に向け、この放熱板３１ａに連結した放熱板２４を上記内側面に向けている。

【００４１】このように．本発明において放熱板２４等の放熱部材の具体的な配置は問わず．コネクタハウジング２６から十分に露出していればよい。

【００４２】第３の実施の形態を図９に示す。ここでは　電子回路基板１４の両端部がコネクタ１６を介して

熱板３８の下面には多数枚のフィン３８ａが形成され、これにより放熱面積の増加が図られている。

【００４３】このような構成によれば、前記第１及び第２の実施の形態で得られる効果に加え、次のような効果を得ることができる。

【００４４】① バスバー基板１３と電子回路基板１４とに挟まれた空間を有効に利用することにより、電気接続箱１０全体を大型化することなく大面積の放熱板３８を配設できる。従って、コンパクトな構造でありながら優れた放熱作用を得ることができる。

【００４５】② 共通の放熱板３８によって複数のコネクタ１６におけるＦＥＴ１８からの放熱を促進でき、部品点数を削減できる。

【００４６】③ 金属製の放熱板３８により、電子回路基板１４の下面をほぼ全域にわたってカバーすることができるので、この放熱板３８はシールド材として兼用が可能であり、これにより電子回路基板１４を電磁波から有効に保護することができる。さらに、前記アッパーケース１２にも金属板を配して電子回路基板１４を上方からも金属板で覆うようにすれば、遮蔽効果は万全となる。

【００４７】次に、第４の実施の形態を図１０～図１２に基づいて説明する。

【００４８】この実施の形態では、前記第１の実施の形態で示したコネクタ１６において、ＦＥＴ１８の放熱部３１ａと放熱板２４との間にペルチェ素子（冷却素子）４０が介設されている。このペルチェ素子４０は、一対の端子を備え、これらの端子同士の間に電流が流されるのに伴い、この電流の大きさに対応する度合いで、上記放熱部３１ａから放熱板２４に向かう方向に強制的に熱移動を起こさせるように構成されている。

【００４９】一方、前記ＦＥＴ１８には、図１２に示すような温度センサ（温度検出手段）４２が組み込まれている。この温度センサ４２は、熱電対等からなり、ＦＥＴ１８の発熱温度に相当する電気信号を出力するように構成されている。

【００５０】図１１に示すように、コネクタ１６の上部には、前記ゲート接続金具２０と水平に並ぶ状態で、このゲート接続金具２０と同等の形状（すなわち電子回路基板１４を挟むクリップ部を有する形状）の一対の冷却サ４２の出力端子が同時接続されるようになっている。

【００５１】上記電子回路基板１４に組み込まれた制御回路は、上述のゲート信号発生部の他、図１２に示すような温度データ解析部４４、電流調節部４６、及び警告指令部４８を備えている。

【００５２】温度データ解析部４４は、温度センサ４２から入力される温度データを解析するものであり、検出温度が第１の判定値以上の場合にその温度に対応した制御信号を電流調節部４６に出力し、検出温度が上記第１の判定値よりも高い第２の判定値以上の場合に警告指令部４８に警告制御信号を出力するように構成されている。

【００５３】電流調節部４６は、上記温度データ解析部４４から制御信号が入力された場合に、この制御信号に対応する電流をペルチェ素子４０の両端子間に流すものである。すなわち、この電流調節部４６は、上記検出温度が一定以上の場合にその温度が高いほど大きな電流をペルチェ素子４０の両端子間に流すように構成されている。また、警告指令部４８は、上記温度データ解析部４４から制御信号が入力された場合に、電気接続箱外部に設けられた図略の警告手段に指令信号を出力し、警告を行わせるように構成されている。

【００５４】このような構成によれば、ＦＥＴ１８の発熱が著しくなると、ペルチェ素子４０の両端子間が通電されてペルチェ素子４０が作動し、ＦＥＴ１８から放熱板４０への強制的な熱移動が引き起こされるので、これによりＦＥＴ１８から放熱板２４を通じての外気への放熱が促進され、ＦＥＴ１８の過度の温度上昇が回避される。また、ＦＥＴ１８の温度が比較的低い場合には、ペルチェ素子４０の作動が停止されるので、ＦＥＴ１８の過冷却による不都合（例えば結露の発生）も防ぐことができる。

【００５５】なお、この実施の形態において、検出の対象となる温度は、上記ＦＥＴ１８自身の発熱温度に限らず、その雰囲気温度やゲート接続金具２０の温度を検出するようにしてもよい。また、ペルチェ素子４０の高温側面（図１０及び図１１では左側面）の温度を検出し、この温度が過度に上昇した場合にペルチェ素子４０の通電を止めるようにすれば、ペルチェ素子４０自身の故障を防ぐこともできる。

は．制御デバイスとしてＩＰＳ（Intelligent Power Switch）を組み込んだコネクタ１６を用いるとともに、このコネクタ１６を、電気接続箱内においてではなく、電源及び負荷に直接接続してその導通制御を行うようにしている。

【００５８】上記ＩＰＳは．パワー部６０と、インテリジェント部６２とを有している。パワー部６０内には、ＦＥＴ等からなるスイッチング素子や内部電源．感温素子等が組み込まれている。インテリジェント部６２は、論理回路等で構成され、上記感温素子等の検出信号に基づいて異常の有無を判定する機能や．外部の制御回路から入力される指令に基づいて上記スイッチング素子のオンオフ制御を行う機能等を備えている。

【００５９】インテリジェント部６２には、アース端子６３と、上記指令が入力される入力端子６４と．上記制御回路に異常診断信号を出力するための診断出力端子６５とが設けられ．これらの端子に接続金具６８が装着されている。一方．上記パワー部６０には、電源端子６７と出力端子６６とが設けられ、電源端子６７に接続金具７７が、出力端子６６に接続金具７６が装着されている。そして、これら全体を一体化すべくその外側にコネクタハウジング７０がモールド成形されてコネクタ１６が構成されており、上記入力端子６４及び診断出力端子６５がそれぞれ接続金具（第２の接続部材）６８を介して上記制御回路に接続されるとともに．電源端子６７が接続金具（第１の接続部材）７７を介して電源に接続され．かつ、出力端子６６が接続金具（第１の接続部材）７６を介して負荷に接続されている。

【００６０】このようなコネクタ１６を用いても．制御デバイスであるＩＰＳの作動により電源－負荷間の通電をオンオフし．かつ、このＩＰＳの作動を制御回路によって制御することができる。そして．この制御回路からＩＰＳを離間させることによって、制御回路の回路要素を保護でき、また、上記ＩＰＳの例えば電源端子６７をコネクタハウジング７０の外面に露出させることにより．効率のよい放熱ができる。さらに．前記と同様、放熱板や適当な冷却素子を導入することにより、放熱効果を高めることができる。

【００６１】また、上記ＩＰＳが複数のスイッチング素子を内蔵する場合．すなわち．第７の実施の形態として

場合．接続金具６８や、接続金具７６．７７に上記電線の端末に設けた電線端子やコネクタを接続するようにしてもよい。

【００６３】このように．本発明のコネクタを電流回路及び制御回路にそれぞれ電線を介して接続した構造には．コネクタの配設位置を自由に設定できるので．特にコネクタ内部に挿入された電子デバイスの放熱が著しい場合．コネクタ部分のみを環境温度が低い場所に設置することにより．上記電子デバイスの熱暴走を防ぐことができる利点が得られる。

【００６４】これに対し．電流回路側においてはその負荷あるいは電源端子に本発明のコネクタの第１の接続部材を直接接続し．制御回路側には本発明のコネクタの第２の接続部材を電線を介して接続する配線形態をとれば．比較的熱に弱い上記制御回路から電流回路を大きく離間させながら．電流回路と本発明のコネクタとの間の経路すなわち大電流が流れる経路を最短化でき．この経路に大電流用の太径電線を配する必要をなくしてコストを著しく削減することが可能である。また、上記大電流経路から出るノイズを最小限の遮断材料を用いて防ぐことができる。

【００６５】また逆に、電流回路に対しては本発明のコネクタの第１の接続部材を電線を介して接続し．制御回路が組み込まれた回路基板の基板用コネクタ等に第２の接続部材を直接接続できるようにした場合には．制御回路と電流回路とを大きく離間させながら、上記基板用コネクタ等に本発明のコネクタを簡単に結合できる利点が得られる。また．大電流が上記回路基板上を流れないので．当該基板の温度上昇や輻射ノイズの発生を防ぐことができ、この基板に組み込まれた制御回路の誤動作を防止できる利点が得られる。

【００６６】本発明においてコネクタ１６を製造する方法は種々考えられるが、その一例を図１６（ａ）～（ｃ）に示す。

【００６７】まず、図１６（ａ）に示すように．ＩＰＳのパワー部６０に電源端子６７及び出力端子６６を装着したものを製造する一方．同図（ｂ）に示すように、アース端子用接続金具７３．診断出力端子用接続金具７４．及び入力端子用接続金具７５が固定されたコネクタハウジング７２をモールド成形しておき．このコネクタ

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【００６８】本発明は、上記の実施の形態のほか、例として次のような形態をとることも可能である。

【００６９】(1) 前記第１の実施の形態等において、コネクタハウジング２６を省略し、ＦＥＴ１８を外部に完全露出させた状態で両基板１３，１４同士の間に介設することも可能である。この場合も、ＦＥＴ１８の放熱部に放熱板２４等の放熱部材を連結したり、この放熱部材とＦＥＴ１８との間にペルチェ素子４０を介在させたりすることにより、放熱効果を促進させることができる。ただし、前記各実施形態のように、上記ＦＥＴ１８を各接続金具２０～２２とともに単一のコネクタ１６として一体化すれば、電気接続箱１０全体の組立作業を容易化できる利点が得られる。

【００７０】(2) 本発明における制御デバイスは上記ＦＥＴ１８やＩＰＳに限らず、その他、ＩＧＢＴ（Insulated Gate Bipolar Transistor）、ＢＰＴ（Bipolar Transistor）、各種レギュレータ、パワーモジュール等が適用可能である。ただし、前記各実施形態に示したように、制御端子（図例ではゲート端子３０）と通電端子（図例ではドレイン端子３１及びソース端子３２）とが互いに反対の側に突出する制御デバイスを用いれば、上記通電端子が上記バスバー基板１３側（図例では下側）を向き、かつ、制御端子が電子回路基板１４側（上側）を向く状態でこの制御デバイスを両基板１３，１４間に介設することにより、接続構造を簡素化できる利点が得られる。

【００７１】(3) 本発明における第１の回路基板は上記のようなバスバー基板１３に限らず、絶縁材料からなる基板に導体が組み込まれた各種回路基板を適用することが可能である。

【００７２】

【発明の効果】以上のように本発明は、電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスを上記電流回路に接続するための第１の接続部材と、上記制御デバイスをこのデバイスの作動を制御する制御回路に接続するための第２の接続部材とをコネクタハウジング内に一体に組み込んだコネクタであるので、このコネクタを上記電流回路と制御回路とに接続することにより、電流回路における電流の制御を行いながら、制御デバイスの放熱から上記制御回路を構成する他の電

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【００７５】さらに、上記放熱部材と放熱部との間に上記放熱部から放熱部材に向けて強制的に熱移動させることにより放熱部を冷却する冷却素子を介在させたものによれば、放熱部からの放熱を積極的に促進させることができる効果が得られる。

【００７６】さらに、上記コネクタハウジングに、上記冷却素子を上記第２の回路基板の制御回路に接続する冷却用接続部材を一体に組み込んだものによれば、この冷却用接続部材を介して冷却素子と制御回路とを接続することにより、この制御回路を利用して冷却素子の作動を制御できる効果が得られる。

【００７７】また、上記第１の接続部材と第２の接続部材とが互いに反対の方向を向いているものによれば、制御デバイスを電流回路と制御回路の双方に接続する作業を容易にでき、配線構造も簡素化できる効果が得られる。

【００７８】さらに、上記通電端子同士の間に絶縁材料からなるセパレータを介在させることにより、通電端子同士が短絡されるのをより確実に回避できる効果が得られる。

【００７９】また本発明は、電流回路が組み込まれた第１の回路基板と、上記電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスの作動を制御する制御回路が組み込まれた第２の回路基板とを備えるとともに、上記第１の回路基板と第２の回路基板との間の位置に上記制御デバイスを配設した電気接続箱であるので、この制御デバイスが第２の回路基板上に実装されている従来構造に比べ、制御デバイスの放熱を促進してその良好な作動を確保できるとともに、この制御デバイスから放たれた熱が第２の回路基板の電子デバイス等に悪影響を与えるのを防止できる効果がある。また、制御デバイスを両基板間の位置に配するのに電気接続箱全体を特別に大型化する必要もなく、コンパクトな構造で上記効果が得られ、制御デバイスと両基板との接続も容易化できる。

【００８０】特に、上記第１の回路基板と第２の回路基板とを略平行な状態で互いに離間させて配置する場合、上記制御デバイスとして、上記第１の回路基板の電流回路に接続される複数の通電端子と上記第２の回路基板の制御回路に接続される制御端子とが互いに反対の方向に

間に複数の制御デバイスを並設するとともに、これら制御デバイスの放熱部に上記第２の回路基板と略平行に延びる共通の放熱部材を連結したものによれば、両基板に挟まれた空間を有効に利用して、電気接続箱全体を大型化させずに大面積の放熱部材を導入でき、その分放熱作用をさらに促進できるとともに、部品点数も削減できる効果が得られる。さらに、上記放熱部材が上記第２の回路基板を片側から覆う状態となるため、この放熱部材を第２の回路基板のシールド材として兼用することにより、第２の回路基板における制御回路を電磁波から有効に保護できる効果も得られる。

【００８３】上記放熱部材と上記制御デバイスの放熱部との間に冷却素子を介在させ、上記放熱部から放熱部材に向けて強制的に熱移動させるようにすれば、放熱部からの放熱をさらに促進させて、制御デバイスの過昇温をさらに確実に防止できる効果が得られる。

【００８４】さらに、上記制御デバイスの温度もしくはこれに対応する温度を検出する温度検出手段を備えるとともに、この温度検出手段により検出された温度に基づいて上記冷却素子の作動を制御する冷却制御部を上記第２の回路基板に組み込むようにすれば、この制御回路を有効に利用して実状に見合った適正な温度制御ができる効果が得られる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態における電気接続箱の全体構造を示す分解斜視図である。

【図２】上記電気接続箱に設けられるコネクタの一部断面側面図である。

【図３】上記コネクタの正面図である。

【図４】図３のＡ－Ａ線断面図である。

【図５】上記コネクタのコネクタハウジング内に組み込まれる各部品の分解斜視図である。

【図６】上記コネクタのコネクタハウジング内に組み込まれている各部品の組立斜視図である。

【図７】（ａ）は上記コネクタに組み込まれるＦＥＴの背面図、（ｂ）は同ＦＥＴの側面図、（ｃ）は同ＦＥＴの正面図である。

【図８】本発明の第２の実施の形態における電気接続箱のコネクタの一部断面側面図である。

【図９】本発明の第３の実施の形態における電気接続箱のコネクタの一部断面側面図である。

【図１１】図１０のコネクタの平面図である。

【図１２】前記第４の実施の形態において電子回路基板に組み込まれる制御回路の機能構成を示すブロック図である。

【図１３】本発明の第５の実施の形態における電気接続箱の要部を示す側面図である。

【図１４】（ａ）は本発明の第６の実施の形態におけるコネクタの平面図、（ｂ）は同コネクタの底面図である。

【図１５】（ａ）は本発明の第７の実施の形態におけるコネクタの平面図、（ｂ）は同コネクタの底面図である。

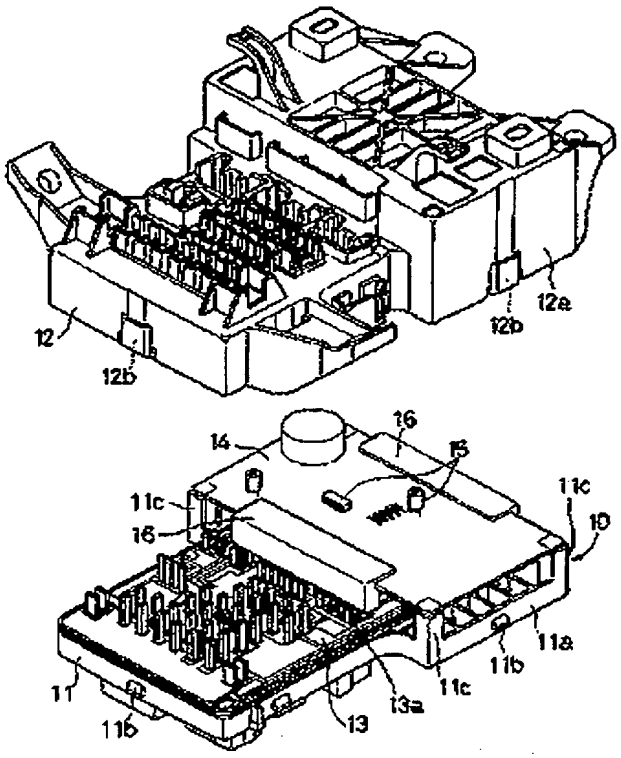
【図１６】（ａ）～（ｃ）は本発明のコネクタの製造工程の一例を示す一部断面斜視図である。

【図１７】従来の電気接続箱の内部構造の一例を示す斜視図である。

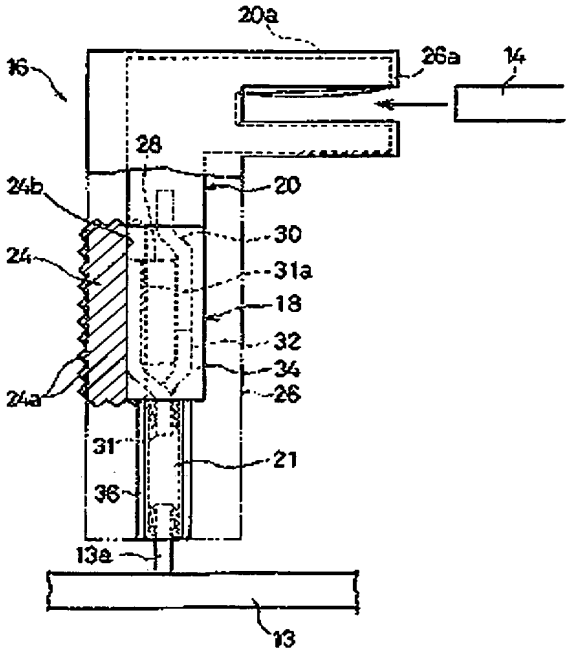
【符号の説明】

１０　電気接続箱
１３　バスバー基板（第１の回路基板）
１４　電子回路基板（第２の回路基板）
１６　コネクタ
１８　ＦＥＴ（制御デバイス）
２０　ゲート接続金具（第２の接続部材）
２１　ドレイン接続金具（第１の接続部材）
２２　ソース接続金具（第１の接続部材）
２４，３８　放熱板（放熱部材）
２６，７０，７２　コネクタハウジング
２８　半導体チップ（ＦＥＴ本体）
３０　ゲート端子（制御端子）
３１　ドレイン端子（通電端子）
３２　ソース端子（通電端子）
３６　セパレータ
４０　ペルチェ素子（冷却素子）
４２　温度センサ（温度検出手段）
４４　温度データ解析部（冷却制御部を構成）
４６　電流調節部（冷却制御部を構成）
５０Ａ，５０Ｂ　冷却用接続金具（冷却用接続部材）
６０　本体チップ（制御デバイスを構成）
６８　接続金具（第２の接続部材）

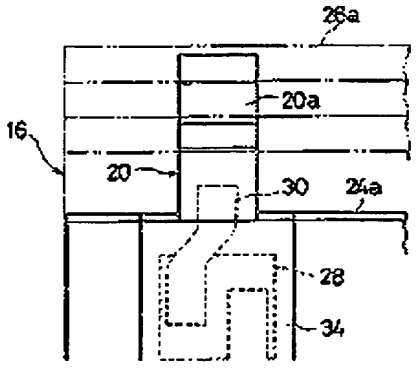
【図1】


12
12b
12a
12b
14
16
15
11c
11c
16
10
11a
11b
11
11b
11c
13a
13

【図2】


20a
26a
14
16
28
24b
20
30
24
31a
18
32
34
26
24a
31
21
36
13a
13

【図3】


26a
20a
16
20
30
24a
28
34

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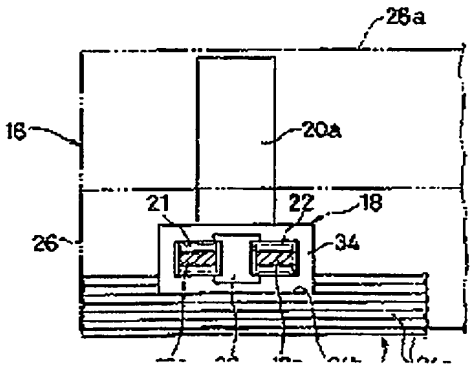
26a
16
20a
21
22
18
26
34

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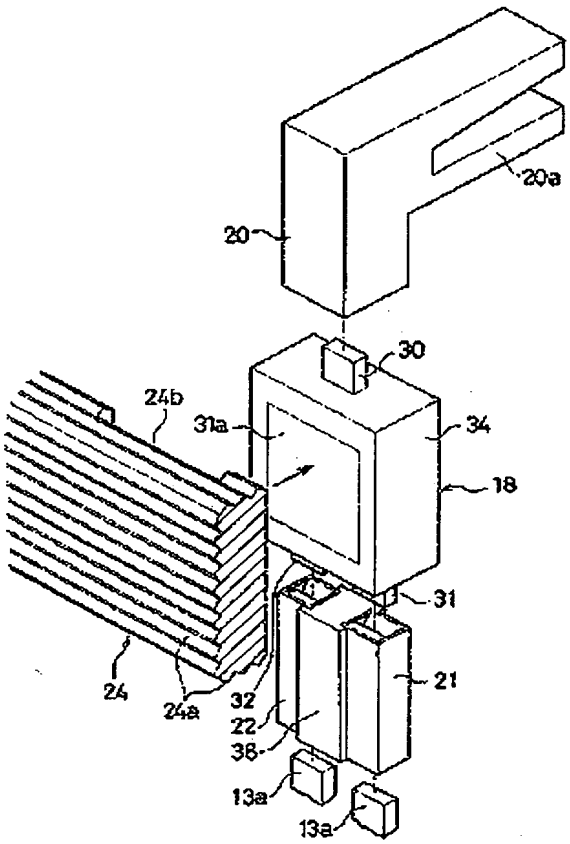
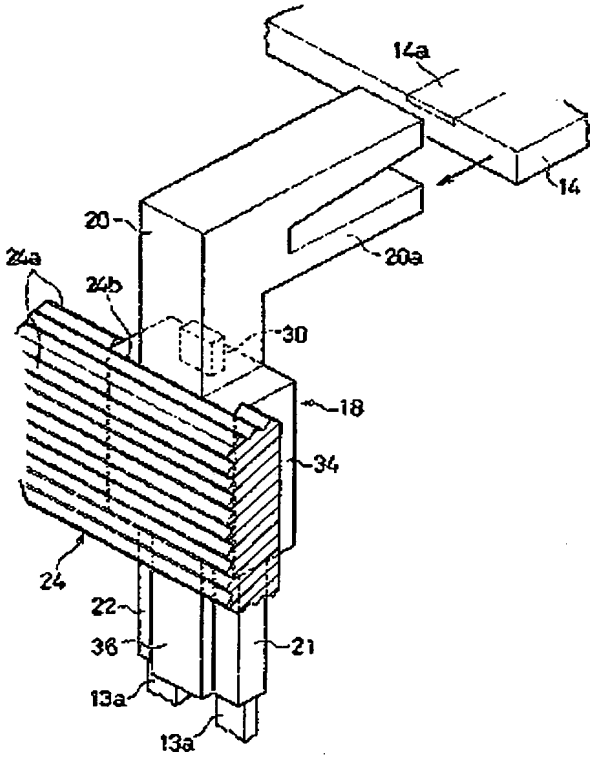
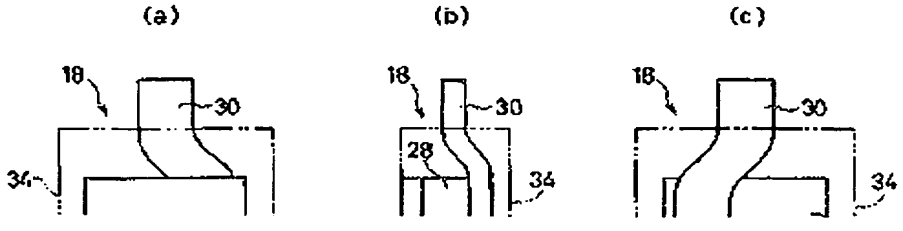

20
20a
30
24b
31a
34
18
31
21
24
24a
32
22
36
13a
13a

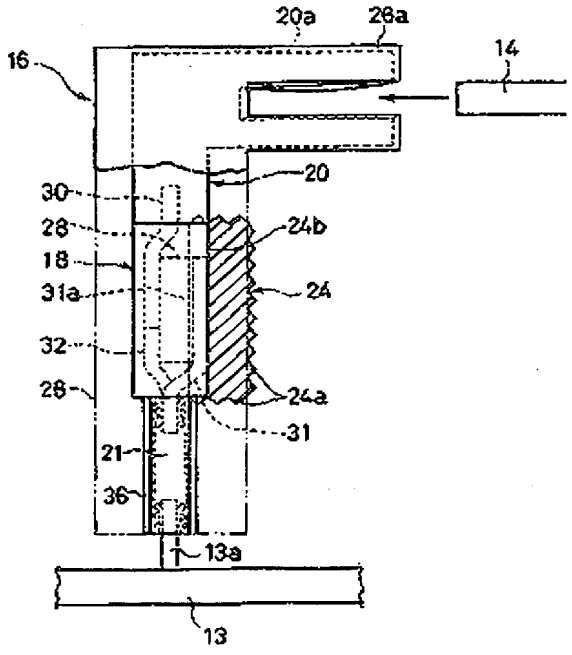
【図6】


14a
14
20
20a
24a
24b
30
18
34
24
22
36
21
13a
13a

【図7】


(a)
(b)
(c)
18
30
36
28
34

【図8】



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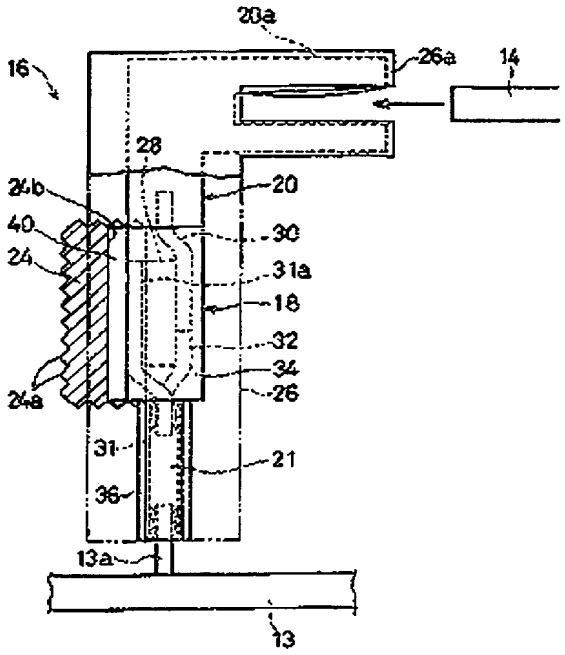

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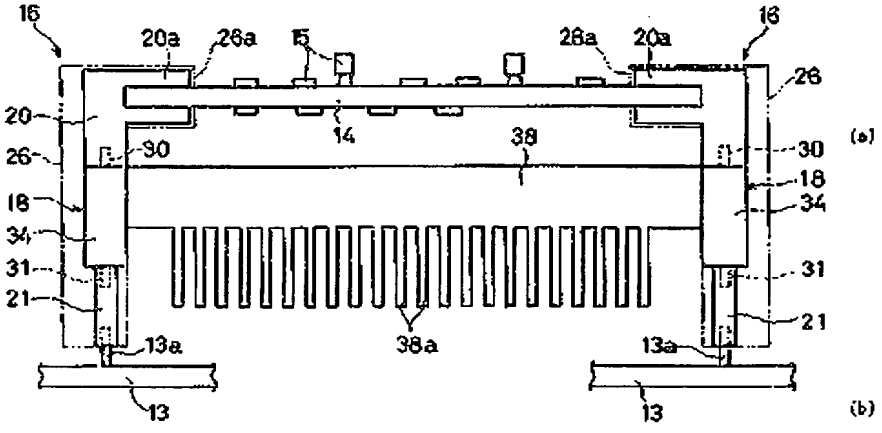

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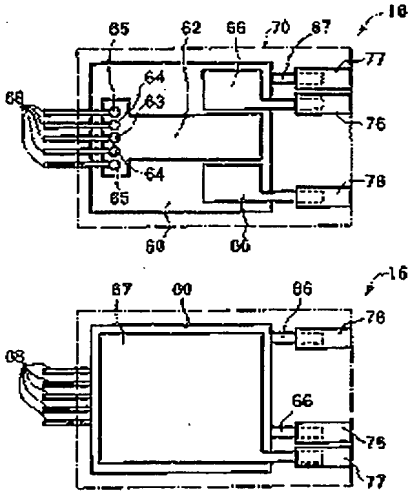
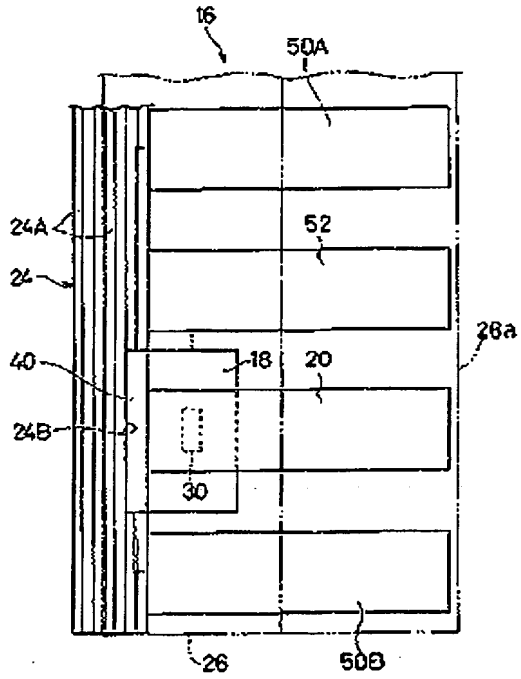
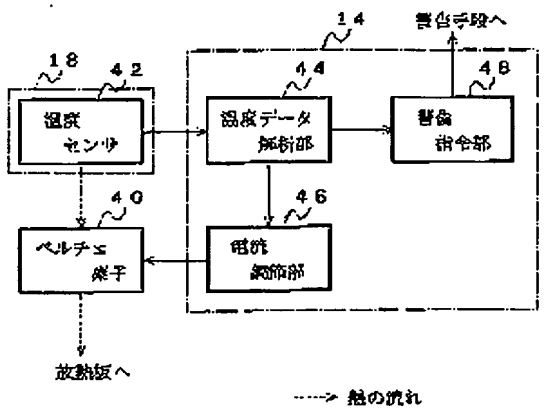


【図17】

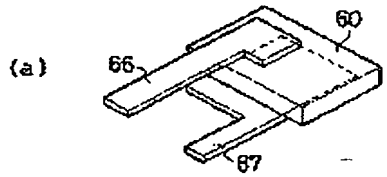
【図１１】



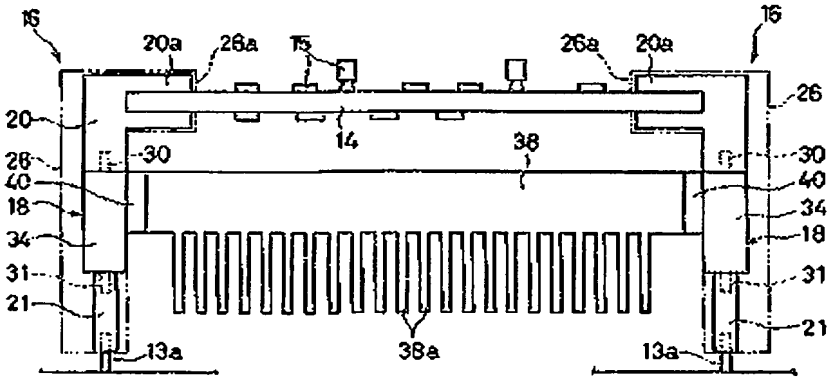
【図１２】

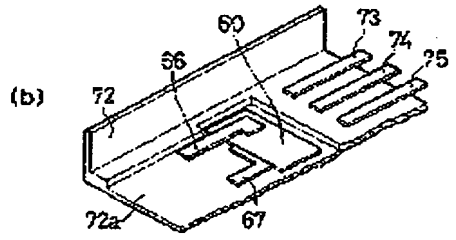


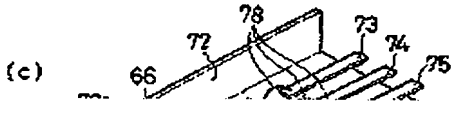
【図１６】



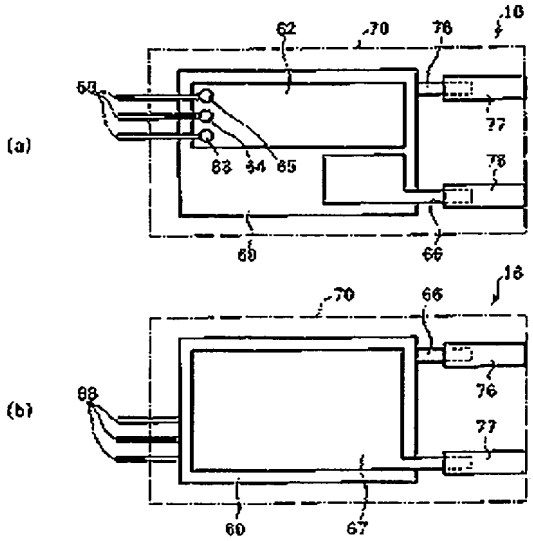
【図１３】







【図１４】



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